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herbaria. The color terms used are mostly from Ridgway's Color Standards and Color Nomenclature (1912).

Genus MALAXIS Solander ex Swartz

MALAXIS PURPUREIFLORA Ames and Quis. sp. nov. Plate 1, fig. 9; Plate 2, figs. 1 to 8; Plate 7.

Radices numerosae, fibrosae. Herba terrestris, prope basim foliosa, circiter 25 cm alta. Caulis brevis, crassus, 3.5 ad 5 cm longus, vaginis tubuliformibus inflatis membranaceis imbricantibus omnino obtectus. Folia 3 ad 8; lamina lanceolato-elliptica ad late elliptica, acuminata, acuta, 7 ad 20 cm longa, 2.5 ad 8 cm lata, nervosa, paulatim in petiolum latum basi dilatatum vaginantem transiens. Pedunculus gracilis, cum racemo 45 ad 46 cm longus. Bractei scariosae, triangulari-lanceolatae, acutae, 4 ad 6 mm longae. Flores juveniles approximati ut videtur, sed tardius remotiores. Sepala petalaque margine valde revoluta. Sepala lateralia suborbicularia, apice late rotundata, circiter 4 mm longa, 3.2 mm lata, 4- ad 5-nervia. Sepalum dorsale oblongo-ellipticum, obtusum, circiter 5.4 mm longum, 2.4 mm latum, 3- ad 5-nervium. Petala anguste oblongo-elliptica, obtusa, 4.75 ad 5 mm longa, 1.4 ad 1.7 mm lata, 3-nervia. Labellum in circuitu suborbiculare, valde auriculatum, circiter 6 mm longum, 5.5 ad 6 mm latum, antice acute pluridentatum cum callo semicirculari lobulato circa gynostemium ornatum, postice in auriculae triangulari-ovatas retrorsas obtusas extensum. Gynostemium per breve, bialatum. Anthera oblata. Pollinia 4, pyriformia, per paria cohaerentia.

Roots numerous, fibrous. Terrestrial herb, about 25 cm tall, leafy at the base. Stems short, stout, 3.5 to 5 cm long, concealed by the swollen, infundibuliform membranaceous leaf-sheaths. Leaves 3 to 8, with petioles imbricating below; lamina lanceolate-elliptic to very broadly elliptic, acuminate, acute, 7 to 20 cm long, 2.5 to 8 cm wide, 5-nerved. Peduncles slender, including the racemes 45 to 46 cm long, provided with triangular-lanceolate, acute, scarious bracts, 4 to 6 mm long. The buds and young flowers at the apex of the racemes crowded, older flowers remote. Sepals and petals with strongly revolute margins. Lateral sepals suborbicular, broadly rounded at the apex, about 4 mm long, 3.2 mm wide, 4- to 5-nerved. Dorsal sepal oblong-elliptic, obtuse, about 5.4 mm long, 2.4 mm wide, 3- to 5-nerved. Petals narrowly oblong-elliptic, obtuse, 4.75 to 5 mm long, 1.4 to 1.7 mm wide, 3-nerved. Labellum suborbicular in

outline, prominently auriculate, about 6 mm long, 5.5 to 6 mm wide, 8- to 10-dentate on the anterior margin, extended at base into a pair of retrorse triangular-ovate rounded auricles. Disc in front of the column, with a semicircular lobulate callus. Gynostemium very short, 2-winged. Pollinia 4, pyriform, in pairs.

LUZON, Benguet Subprovince, near Baguio, on rocks on the Naguilian Trail, *Phil. Nat. Herb. 79 Mrs. K. B. Day*, June 29, 1934.

The species is especially characterized by the purple color on the lower surface of the leaves, the purple flowers and the 8- to 10-sharp-toothed labellum. It differs from all its nearest allies—*M. atrosanguinea* Ames, *M. bulusanensis* Ames, and *M. Taylori* Ames—in its much broader petals and in the teeth on the anterior margin of the lip.

Genus NEPHELAPHYLLUM Blume

NEPHELAPHYLLUM MINDORENSE Ames. Plate 1, figs. 3 and 4; Plate 2, figs. 21 to 31; Plate 8.

Nephelaphyllum mindorense AMES in Philip. Journ. Sci. 2 (1907) Bot. 316, Orch. 3 (1908) 83, *t. 55*, 5 (1915) 48, in Merr. Enum. Philip. Fl. Pl. 1 (1924) 280.

"Closely allied to *N. pulchrum* Blume. Plants about 2 dm. tall. Rhizome creeping, slender, rooting at intervals. Stems purple. Leaves with the under surface uniformly dark purple, upper surface mottled, ovate-lanceolate, acuminate, acute, 8–10 cm. long, 3–5.5 cm. wide near the base. Petioles relatively slender, about 3 cm. long. Peduncles exceeding the leaves, clothed with several scarious, tubular, acute sheaths. Inflorescence loosely few-flowered. Bracts about 1 cm. long, linear, acute, scarious, somewhat shorter than the pedicels of the white flowers. Lateral sepals linear-acute, 1-nerved, 9 mm. long, 1.5 mm. wide. Upper sepal similar and equal to the laterals. Petals oblong, acute, slightly broader above than below the middle, 1-nerved, about 8 mm. long, 3 mm. wide. Labellum suborbicular, entire, 9–10 mm. long, 9–10 mm. wide, with 3 prominent converging lamellae near the apex, which pass basally into the main nerves of the hairy disc. Spur blunt, inflated, 4–5 mm. long."—AMES, loc. cit.

LUZON, Benguet Subprovince, Baguio, *Phil. Nat. Herb. 80 Mrs. K. B. Day*, June 29, 1934: Nueva Ecija Province, Mount Umingan, *Bur. Sci. 26319, 26494, 29652 Ramos and Edaño*, August and September, 1916. MINDORO, along Binabay River, *Merrill 5623* (type in Phil. Nat. Herb.), November 2, 1906.

The peduncles are purple; sepals and petals pale grass green flushed with light brownish olive and lined with purple-drab; labellum white except the lamellæ orange-chrome; anther orange

chrome. Terrestrial orchids on dry slopes and in humid forests at 200 to 1,700 meters altitude.

NEPHELAPHYLLUM PULCHRUM Blume.

Nephelaphyllum pulchrum BLUME Bijdr. (1825) 373, *f. 22*, Fl. Jav. Orch. (1858) 144, *t. 61, f. 1, t. 54 F;* LINDL. Gen. & Sp. Orch. (1830) 24; REICHB. F. Xenia Orch. 1 (1856) 216, *t. 88, f. 1;* MIQ. Fl. Ind. Bat. 3 (1859) 675; Bot. Mag. 88 (1862) *t. 5332;* HOOK. F. Fl. Br. Ind. 5 (1890) 818; J. J. SM. Fl. Buitenz. 6 (Orch. Java) (1905) 178, Fig.-Atlas (1909) *fig. 135;* SCHLTR. Die Orchideen (1927) 127.

The original description reads as follows:

"N: floribus dense spicatis, labelli limbo lineis tribus muricatis.
"*Crescit:* in locis humidioribus sylvarum Salak.
"*Floret:* Januario–Aprili."—BLUME.

Plants ascending, 10 to 15 cm high; rhizome creeping, slender, rooting at intervals. Leaves three in our plant, submembranaceous, ovate or triangular-ovate, subcordate at the base, acuminate-acute at apex, 8.4 to 9 cm long, 4 to 4.2 cm wide near the base, uniformly dark purple beneath, silvery green with dark green reticulations above; petioles 1.3 to 1.8 cm long. Inflorescence terminal, few-flowered; the peduncle clothed with several scarious tubular sheaths, erect, about 4 cm or more long. Flowers about 2.8 cm across. Sepals and petals reflexed. Sepals linear, acute, about 12.7 mm long, 1.8 to 2 mm wide. Petals oblong-linear, acute, about 13 mm long, 3 mm wide. Labellum large, oblong-obovate when expanded, cuneate at the base, slightly retuse, about 10.5 mm long, 11 mm wide when stretched out, with three elevated dentate or lacerate lamellæ near the apex; base of the labellum extended into a short didymous spur about 5 mm long. Column stout in proportion to the size of the flower, semiterete, the margin expanded into a wing along each side. Anther two-horned. Pollinia 8, unequal, in pairs.

PALAWAN, on rocks along the bank of Iwahig River, *Bur. Sci. 81158 E. H. Taylor,* September 18, 1923.

The single collection here cited appears to be referable to *Nephelaphyllum pulchrum* Blume, although the long acuminate leaves seem aberrant from those of the typical form.

This species differs from *N. mindorense* Ames in having much larger flowers and dentate (not subentire) keels on the lip.

Besides the Philippines, it occurs in Borneo, Java, Sumatra, and the Straits Settlements.

Genus PLOCOGLOTTIS Blume

PLOCOGLOTTIS LUCBANENSIS Ames. Plate 1, figs. 7 and 8; Plate 2, figs. 9 to 20.

Plocoglottis lucbanensis AMES in Elm. Leafl. Philip. Bot. 5 (1912) 1572, Orch. 5 (1915) 100, in Merr. Enum. Philip. Fl. Pl. 1 (1924) 338.

"Herba terestris. Caules subcaespitosi, purpurei, ad basim incrassati, fibris elongatis ornati, monophylli. Folium oblongi-lanceolatum, acutum, acuminatum ad basim attenuatum, circiter 3.8 dm. longum, usque ad 3.5 cm. latum in petiolum gracilem elongatum contractum distincte 3-nervium. Scapi aphylli a basi caulium laterales, longi, erecti, circiter 6 dm. longi, vaginati, pubescentes. Racemi abbreviati. Bracteae inflorescentiae lanceolatae, acutae, pubescentes, ± 5 mm. longae. Pedicellus cum ovario circiter 1.2 cm. longus, pubescens. Flores atro-flavidi, purpureo-maculati, pubescentes. Sepala lateralia crassa 12 mm. longa, acuta, ad apicem subcucullata, oblongi-lanceolata, extus pubescentia, 5-nervia. Sepalum posticum oblongum, obtusum. Petala 11 mm. longa, linearia, falcata, ad apicem sensim dilatata et incrassata. Labellum crassum 8 mm. longum, circiter 4 mm. latum, ad apicem in apiculo productum. Apiculus valde deflexus, recurvatus. Columna scabrata.

"Aside from a slight thickening of the nerves the labellum appears to be ecallose.

"LUZON, Province of Tayabas, Lucban, May, 1907, *A. D. E. Elmer*, 7707.

"Small tufted terrestrial herbs in damp soil of wooded ravines at 2,750 feet altitude. Pseudobulbs and stems conspicuously purple; leaves submembranaceous; buds whitish; flower dull yellow, spotted with purple. Rare!"—AMES in Elm. Leafl. Philip. Bot. 5 (1912) 1572.

BABUYAN ISLANDS (CAMIGUIN ISLAND), *Bur. Sci. 4147 Fenix*, July 16, 1907. LUZON, Benguet Subprovince, Baguio, *Phil. Nat. Herb. 50 Mrs. K. B. Day*, May 21, 1934: Laguna Province, *For. Bur. 28939 Willie and Salvoza:* Tayabas Province, Lucban, *Elmer 7707* (type), May, 1907: Sorsogon Province, Irosin, Mount Bulusan, *Elmer 17123*, September, 1916.

The peduncles are purplish; sepals and petals light cadmium and spotted with nopal red; labellum pinard yellow; column pinard yellow at apex and white at base; pedicellate ovary white.

Genus DENDROBIUM Swartz

DENDROBIUM BUKIDNONENSE Ames and Quis. sp. nov. Plate 1, figs. 5 and 6; Plate 3, figs. 1 to 7; Plate 9, fig. 1.

Caules aggregati, 23.5 ad 50 cm longi, basi ovoideo-incrassati, supra attenuati. Folia disticha, linearia, obtusa, 4 ad 7 cm longa, 3 ad 4 mm lata. Racemi breves; flores singuli succedanei, circiter 1.4 cm dimetiente. Sepala lateralia late triangularia, apice rotundato subacuta, 6.5 ad 8 mm longa, circiter 15.6 mm secundum columnae pedem lata, 6- to 7-nervia. Sepalum

dorsale oblongo-ovatum, subacutum, 6 ad 7 mm longum, circiter 3.5 mm latum, 5- to 7-nervium. Petala oblongo-elliptica, obtusa, 5.5 ad 7 mm longa, 2.9 ad 3.5 mm lata, 1-nervia. Labellum cuneato-obovatum, simplex obscurrissime trilobatum, crenulatum, 15.7 ad 18 mm longum, 9 ad 11 mm latum. Columna breve, in pedem perlongum extensa.

Stems aggregated, similar in habit to those of *Dendrobium crumenatum* Sw., 23.5 to 50 cm long. Pseudobulbs or ovoid thickenings at the base of the stems, 2 to 4 cm long, 1.3 to 1.5 cm in diameter, conspicuously many-ridged with rounded angles. Leaves distichous, linear, obtuse, 4 to 7 cm long, 3 to 4 mm wide. Racemes short; the flowers appearing singly, about 1.4 cm across. Lateral sepals broadly triangular, subacute, 6.5 to 8 mm long, about 15.6 mm broad along the column-foot, 6- to 7-nerved. Dorsal sepal oblong-ovate, subacute, 6 to 7 mm long, about 3.5 mm wide, 5- to 7-nerved. Petals oblong-elliptic, obtuse, 5.5 to 7 mm long, 2.9 to 3.5 mm wide, 1-nerved. Spur or mentum conical with elongated apex. Labellum simple, cuneate-obovate, crenulate on the anterior margins, 15.7 to 18 mm long, 9 to 11 mm wide when expanded at the broadest portion. Disc with slightly thickened veins—especially the central one—and with scattering papillæ at the center near the apex. Column very short, extended into a very long foot.

LUZON, Manila, Bureau of Science orchid house, *Bur. Sci. 85617 E. Quisumbing*, December 14, 1932. Living specimens were presented to the junior author by Mr. L. H. Phillips, formerly of Bukidnon, Mindanao, who collected them from the hills of Bukidnon. The plants have flowered several times in the Bureau of Science orchid house during the months of July, August, and December. The flowers are not fugacious (remaining fresh for two days) and are slightly fragrant. The sepals are marguerite yellow. The petals almost white with a slight tinge of primrose yellow at the tips, and the spur slightly cream-colored; the ridge at the middle of the labellum apricot yellow.

This species is allied to *Dendrobium gracile* (Bl.) Lindl., but differs in not having subulate leaves, in its oblong-ovate dorsal sepal, and in the color of the flowers.

Genus BROMHEADIA Lindley

BROMHEADIA PHILIPPINENSIS sp. nov. Plate 1, figs. 1 and 2; Plate 4; Plate 9, fig. 2.

Herba epiphytica. Caules e rhizomate ramoso exorti, complanati, erecti, 26 ad 54 cm alti, vaginis foliorum omnino obtecti;

internodia 2 ad 3 cm longa. Folia disticha, patentia, ligulata, subcoriacea, 10.5 ad 17.5 cm longa, 1.1 ad 1.6 cm lata, apice valde bilobata, lobis inaequilateralibus. Inflorescentia terminalis, 4 ad 6 cm longa, simplex, fere sessilis; bracteae distichae, rigidae, imbricantes, cymbiformes, acutae, 6 ad 8 mm longae. Flores singuli apparentes, albi, odorati, 2.5 ad 2.6 cm longi, 2.2 ad 2.4 cm dimetiente. Pedicellus cum ovario gracilis, circiter 1.4 cm longus. Sepala lateralia lanceolata, paulo obliqua, carinata, acuta, circiter, 2.3 cm longa, 7 mm lata. Sepalum dorsale oblanceolato-oblongum, acutum, circiter 2.5 cm longum, 7 mm latum. Petala anguste lanceolata vel anguste oblanceolata, obliqua, acuta, circiter 2.2 cm longa, 5.75 mm lata. Labellum in circuitu late oblongum, brevissime unguiculatum, supra medium trilobatum, circiter 1.7 cm longum et 9.5 mm latum; lobi laterales parvi, ovato-triangulares, obtusi, 2 ad 2.5 mm longi; lobus medius subquadratus, antice truncatus et minute apiculatus, 6 ad 6.5 mm latus, medio calloso-elevato et flavo. Discus cum parte longitudinali centrali calloso-elevata pubescenti in callum distinctum terminanti. Columna crassiuscula, recta, vel paulo incurvata, antice excavata, circiter 14 mm longa. Clinandrium parvum; anthera late ovoidea, apice obtusa, margine anteriore profunde emarginato. Pollinia 2, triangulari-ovoidea, dorso excavata.

Plants growing ascendingly on tree trunks. Roots fibrous, flexuous, stout, glabrous. Stems flattened, 26 to 54 cm long, arising from terete, branching rhizomes; internodes shortest at base, 2 to 3 cm long, entirely or almost entirely concealed by the flattened leaf-sheaths. Leaves distichous, ligulate, subcoriaceous when dry, 10.5 to 17.5 cm long, 1.1 to 1.6 cm wide, strongly bilobed at the apex with the lobes inequilateral. Inflorescence terminal, simple, almost sessile, 4 to 6 cm long; bracts distichous, rigid, imbricated, cymbiform, acute, 6 to 8 mm long. Flowers appear singly, rather fleshy, white, fragrant, 2.5 to 2.6 cm long, 2.2 to 2.4 cm across. Pedicellate ovary slender, about 1.4 cm long. Lateral sepals lanceolate, oblique, carinate near the apex, acute, about 2.3 cm long, 7 mm wide. Dorsal sepal oblanceolate-oblong, acute, about 2.5 cm long, 7 mm wide. Petals narrowly lanceolate or narrowly oblanceolate, oblique, acute, about 2.2 cm long, 5.75 mm wide. Labellum very slightly unguiculate, broadly oblong, trilobed in outline above the middle, about 1.7 cm long and 9.5 mm wide; lateral lobes very small, ovate-triangular, obtuse, 2 to 2.5 mm long; middle lobe subquadrate, truncate and minutely apiculate, 6 to 6.5 mm wide, with the center callose-elevated and yellow.

Disc with a central longitudinal fleshy pubescent zone ending in a distinct callus. Column thick, straight or slightly incurved, concave in front, with winged margins, about 14 mm long. Clinandrium small; anther broadly ovoid, obtuse at the apex, cucullate. Pollinia 2, triangular-ovoid, the dorsal side excavated, about 1.5 mm long.

MINDANAO, Zamboanga Province, Mount Silingan, *Phil. Nat. Herb. 3000 Mrs. K. B. Day*, November, 1934.

The description was based on living specimens given to the junior author by Mrs. Day and now cultivated in the Bureau of Science orchid house. The flowers have the general appearance and habit of opening of *Sarcochilus pallidus*. Pedicellate ovary chalcedony yellow; sepals and petals white with naphthalene yellow tips; labellum white with the callus on the front lobe apricot yellow; column naphthalene yellow.

The genus *Bromheadia* is new to the Philippines. *Bromheadia philippinensis* is apparently closely allied to *B. alticola* Ridl., but differs in its apparently dissimilar habit of growth and the obtuse outward-pointing side lobes of the lip.

Genus ASCOGLOSSUM Schlechter

ASCOGLOSSUM CALOPTERUM (Reichb. f.) Schltr. Plate 1, figs. 12 and 13; Plate 5, figs. 1 to 10.

Ascoglossum calopterum (Reichb. f.) SCHLTR. in Fedde Repert. Beihefte 1 (Orchidaceen von Deutsch-Neu Guinea) (1914) 975; 21 (Fig. Atlas) (1923) *t. 343*, No. 1324.

Saccolabium calopterum REICHB. F. in Gard. Chron. (1882) 2: 520.

Cleisostoma cryptochilum F. v. MUELL. in Wing South Sci. Rec. n. 5 1 (1885).

Saccolabium Schleinitzianum KRANZL. in Engl. Bot. Jahrb. 7 (1886) 440.

Caules erecti vel curvati, rigidi, teretes, 20 ad 30 cm longi, vix 1 cm dimetiente. Folia disticha, rigida, ligulata, approximata, valde coriacea, apice rotundato inaequaliter obtuse bilobata, 11 ad 18.5 cm longa, 2 ad 3 cm lata. Inflorescentiae laterales paniculatae, multiflorae, 20 ad 35 cm longae; pedunculus erectus, rigidus, 12 ad 15 cm longus, vaginis brevibus tubularibus, 4 ad 5 mm longis ornatus. Pedicellus cum ovario gracilis, 11 ad 15 mm longus. Flores inodori feri, purpurei, 15 ad 17 mm longi, 6 ad 8 mm dimetiente; perianthii parte valde reflexae. Sepala lateralia unguiculata, acuta vel obtusa, 9 ad 12 mm longa, 4.5 ad 5 mm lata, ad basim vix 1.25 mm lata, supra medium lobulo ovato-triangulari plus minusve distincto ornata. Sepalum dorsale oblongo-oblanceolatum, acutum vel

subacutum, 9 ad 10.5 mm longum, 3 ad 3.25 mm latum. Petala elliptico-lanceolata, apice attenuata, acuta, 8.5 ad 9.5 mm longa, 2.75 ad 3 mm lata. Labellum calcaratum, trilobatum; lobi laterales erecti, apice oblique truncati, postice ad columnam attingentes; lobus medius e calcaris medio exoriente, minutus, reflexus, lineari-lanceolatus, apice obtusus, 2.5 ad 3 mm longus, 0.75 ad 0.9 mm latus. Calcar cylindricum, leviter curvatum, apice lateraliter abrupte inflatum et rotundatum, 10.25 ad 11 mm longum. Columna rigida, perbrevis, crassa, 4.5 ad 5 mm alta. Anthera obovoidea, 1.7 ad 1.8 mm longa. Pollinia oblonga.

Roots dark gray, elongate, 3.5 to 4 mm in diameter. Stems erect or curved, rigid, terete, 20 to 30 cm long, about 1 cm in diameter. Leaves distichous, rigid, ligulate, approximate, very leathery, unequally bilobed at the rounded apex with obtuse lobules, 11 to 18.5 cm long, 2 to 3 cm wide. Panicles lateral, many-flowered, 20 to 35 cm long; peduncles erect, rigid, 12 to 15 cm long; sheaths short, tubular, 4 to 5 mm long. Pedicellate ovary slender, 11 to 15 mm long. Flowers odorless, 15 to 17 mm long, 6 to 8 mm wide. Lateral sepals unguiculate, parallel, oblanceolate, acute or obtuse, 9 to 12 mm long, 4.5 to 5 mm wide, the very base about 1.25 mm wide, above the middle provided with a more or less distinct triangular-ovate lobule. Dorsal sepal oblong-oblanceolate, acute or subacute, 9 to 10.5 mm long, 3 to 3.25 mm wide. Petals parallel, elliptic-lanceolate, narrowed to the acute apex, 8.5 to 9.5 mm long, 2.75 to 3 mm wide. Labellum spurred, trilobed; lateral lobes erect, obliquely truncate at the apex, attached to the column at the base; middle lobe very small, linear-lanceolate, reflexed, obtuse at the tip, 2.5 to 3 mm long, 0.75 to 0.9 mm wide. Spur cylindric, elongate, curved, laterally abruptly dilated and rounded at the apex, 10.25 to 11 mm long, 3 to 3.5 mm in diameter at the very apex, when viewed from the front. Column rigid, very short and thick, 4.5 to 5 mm high. Anther obovoid, 1.7 to 1.8 mm long. Pollinia oblong.

DINAGAT ISLAND, Osmeña, Dinagat, *Phil. Nat. Herb. 387 L. E. Hachero,* October, 1933. Growing on tree trunks in the coastal forests on Dinagat Island, northeast of Mindanao. Living plants were sent to the junior author through Dr. E. B. Copeland, formerly of the Economic Garden, Bureau of Plant Industry, and have flowered in the Bureau of Science orchid house twice—May 12, 1934, and March 6, 1935. The flowers remain fresh on the plant for two weeks.

Sepals and petals rosolane purple dotted with true purple; pedicellate ovary aster purple; middle lobe of the labellum and throat onion skin pink; spur pomegranate purple.

A very interesting species with very leathery dark green leaves and conspicuous purple flowers, of which the lateral sepals and petals are reflexed and parallel. It differs from any typical *Renanthera* in its long clavate spur and minute narrow middle lobe of the labellum.

This species belongs to the genus *Ascoglossum* Schltr., a new genus for the Philippines. The genus is closely allied to *Renanthera* but differs in that the lateral lobes reach much higher than the mid-lobe.

Genus TRICHOGLOTTIS Blume

TRICHOGLOTTIS AGUSANENSIS Ames and Quis. sp. nov. Plate 1, figs. 10 and 11; Plate 6, figs. 1 to 10.

Herba epiphytica, erecta, rigida, 22 ad 35 cm alta. Caules foliosi, internodiis 2 ad 3 cm longis. Foliorum vaginae cylindricae, internodiis vix aequilongae. Folia disticha, ligulata, coriacea, in sicco rugosa, 14 ad 15.5 cm longa, 1.7 ad 2 cm lata, apice inaequaliter rotundato-bilobata. Inflorescentiae oppositifoliae, paniculatae, 12 ad 13 cm longae, 10- ad 12-florae. Bracteae inflorescentiae rigidae, squamiformes, 1.5 ad 2 mm longae. Flores carnosi, 16 ad 17 mm dimetiente. Sepala lateralia ovato-elliptica, acuta vel subacuta, 8.5 ad 9.5 mm longa, 6 ad 6.5 mm lata. Sepalum dorsale obovato-ellipticum, apice late rotundatum, 9 ad 10 mm longum, 6 ad 6.5 mm latum. Petala elliptico-obovata, apice rotundata, 8.5 ad 9 mm longa, 4.5 ad 5.5 lata. Labellum basi breviter saccatum, 3-lobatum, 8 ad 9 mm longum; lobi laterales breves, erecti, indistincti, 1 ad 1.25 mm alti; lobus medius lanceolatus, antice attenuatus, supra medium abrupte inflexus, apice ipso truncato-dilatatus. Discus valde calloso-incrassatus et pubescens.

Epiphytes with elongated roots. Stems rigid, foliose, erect or more or less arcuate, 22 to 35 cm high; internodes 2 to 3 cm long. Leaf sheaths cylindric, almost as long as the internodes. Leaves distichous, ligulate, coriaceous, rugose when dry, 14 to 15.5 cm long, 1.7 to 2 cm wide, unequally bilobed at the apex with rounded lobules. Inflorescences opposite the leaves, shorter than the leaves, paniculate, 12 to 13 cm long, 10- to 12-flowered. Bracts of the fractiflex inflorescence rigid, squamiform, concave, 1.5 to 2 mm long. Flowers fleshy, odorless, 16 to 17 cm across. Pedicellate ovary, 10 to 11 mm long. Lateral sepals ovate-

elliptic, acute or subacute, 8.5 to 9.5 mm long, 6 to 6.5 mm wide. Dorsal sepal obovate-elliptic, broadly rounded at the apex, 9 to 10 mm long, 6 to 6.5 mm wide. Petals elliptic-obovate, rounded at the apex, 8.5 to 9 mm long, 4.5 to 5.5 mm wide. Labellum 3-lobed, shallowly saccate at base, 8 to 9 mm long; lateral lobes short, erect, indistinct, with free portion 1 to 1.25 mm high; middle lobe lanceolate, attenuate toward the apex, above the middle abruptly inflexed, truncate dilated at the very tip. Disc strongly callose-thickened and pubescent through the center. Between the basal lobes there is a ligulate, pubescent upcurved appendage which is about 2.5 mm long. Gynostemium very short and stout, pubescent, with a pair of falcate, narrow, elongate, pubescent auricles which are 2.5 to 3 mm long.

LUZON, Rizal Province, Mariquina, Mrs. M. L. Quezon's gardens, *Phil. Nat. Herb. 3005 E. Quisumbing*, January 16, 1935.

The living plants were sent from Agusan by Attorney José Rodriguez. Pedicellate ovary lumiere green. Sepals and petals bright chalcedony yellow lined with vinaceous rufous. Lateral lobes of the lip white; the middle lobe white with two eugenia red lines above, apex and base between the lateral lobes cadmium yellow, callus white.

This species is allied to *Trichoglottis ionosma* (Lindl.) J. J. Sm., but is a much smaller plant throughout with less prominent spurred base to the lip.

ILLUSTRATIONS

PLATE 1

FIG. 1. *Bromheadia philippinensis* Ames and Quis. sp. nov., front view of flower, × 1.

2. *Bromheadia philippinensis* Ames and Quis. sp. nov., side view of flower, × 1.

3. *Nephelaphyllum mindorense* Ames, front view of flower, × 2.

4. *Nephelaphyllum mindorense* Ames, side view of flower, × 2.

5. *Dendrobium bukidnonense* Ames and Quis. sp. nov., front view of flower, × 2 (circa).

6. *Dendrobium bukidnonense* Ames and Quis. sp. nov., side view of flower, × 2 (circa).

7. *Plocoglottis lucbanensis* Ames, front view of flower, × 1.

8. *Plocoglottis lucbanensis* Ames, side view of flower, × 1.

9. *Malaxis purpureiflora* Ames and Quis. sp. nov., front view of flower (natural position), × 3 (circa).

10. *Trichoglottis agusanensis* Ames and Quis. sp. nov., front view of flower, × 2.

11. *Trichoglottis agusanensis* Ames and Quis. sp. nov., side view of flower, × 2.

12. *Ascoglossum calopterum* (Reichb. f.) Schltr., front view of flower, × 1.

13. *Ascoglossum calopterum* (Reichb. f.) Schltr., side view of flower, × 1.

PLATE 2

Malaxis purpureiflora Ames and Quis. sp. nov.: *1*, dorsal sepal, × 5.5; *2*, petal, × 5.5; *3*, lateral sepal, × 5.5; *4*, front view of column and labellum (natural position), × 5.5; *5*, side view of ovary, column, and labellum (natural position) × 5.5; *6*, anther from above, × 14; *7*, anther from below, × 14; *8*, pollinia, very much enlarged. (All figures drawn with aid of camera lucida.)

Plocoglottis lucbanensis Ames: *9*, dorsal sepal, from back, × 2; *10*, side view of dorsal sepal, × 2; *11*, petal (flattened), × 2; *12*, exterior view of lateral sepal, × 2; *13*, side view of lateral sepal, × 2; *14*, side view of ovary, column, and labellum (natural position), × 4; *15*, front view of column, × 4; *16*, column and labellum (natural position) from above, × 4; *17*, labellum from above (natural position), × 4; *18*, labellum from above (stretched out), × 4; *19*, anther from above, × 7; *20*, anther from below, × 7. (Figs. 19 and 20 were drawn with the aid of a camera lucida.)

Nephelaphyllum mindorense Ames: *21*, dorsal sepal, × 3; *22*, petal, × 3; *23*, lateral sepal, × 3; *24*, side view of ovary, column, and labellum (natural position), × 3; *25*, labellum from above (natural position), × 3; *26*, labellum from above (stretched out), × 3; *27*, front view of spur, × 4; *28*, front view of column, × 3; *29*, side view of column, × 3; *30*, anther from above, × 5.5; *31*, anther from below, × 5.5. (Figs. 30 and 31 were drawn with the aid of a camera lucida.)

PLATE 3

Dendrobium bukidnonense Ames and Quis. sp. nov.: *1*, dorsal sepal, × 7; *2*, petal, × 7; *3*, lateral sepal, × 7; *4*, labellum from above (somewhat expanded), × 4; *5*, side view of ovary and column, × 7; *6*, front view of column, × 7; *7*, anther, × 11.

PLATE 4

Bromheadia philippinensis sp. nov.: *1*, dorsal sepal, × 2; *2*, petal, × 2; *3*, lateral sepal, × 2; *4*, labellum from above (natural position), × 4; *5*, labellum from above, (stretched out), × 4; *6*, front view of column, × 4; *7*, side view of column, × 4; *8*, pollinia, × 12.

PLATE 5

Ascoglossum calopterum (Reichb. f.) Schltr.: *1*, habit, one-third natural size; *2*, dorsal sepal, × 2.66 (circa); *3*, petal, × 2.66 (circa); *4*, lateral sepal, × 2.66 (circa); *5*, front view of flower, × 2; *6*, side view of flower, × 2; *7*, longitudinal section of the labellum and spur, × 2; *8*, anther from above, × 4.66 (circa); *9*, anther from above, × 4.66 (circa); *10*, pollinia, × 4.66 (circa). (Figs. 8 to 10 drawn with aid of camera lucida.)

PLATE 6

Trichoglottis agusanensis Ames and Quis. sp. nov.: *1*, habit, one-third natural size; *2*, dorsal sepal, × 1.33 (circa); *3*, petal, × 1.33 (circa); *4*, lateral sepal, × 1.33 (circa); *5*, side view of ovary, column, and labellum (natural position), × 2; *6*, front view of column and labellum (natural position), × 2; *7*, column and labellum from above (natural position), × 2; *8*, anther from above, × 4; *9*, anther from below, × 4; *10*, pollinia, × 4.

PLATE 7

Malaxis purpureiflora Ames and Quis. sp. nov.: habit, much reduced.

PLATE 8

Nephelaphyllum mindorense Ames: habit, slightly larger than natural size.

PLATE 9

FIG. 1. *Dendrobium bukidnonense* Ames and Quis. sp. nov.: habit, very much reduced.

2. *Bromheadia philippinensis* Ames and Quis. sp. nov.: habit, very much reduced.

PLATE 1.

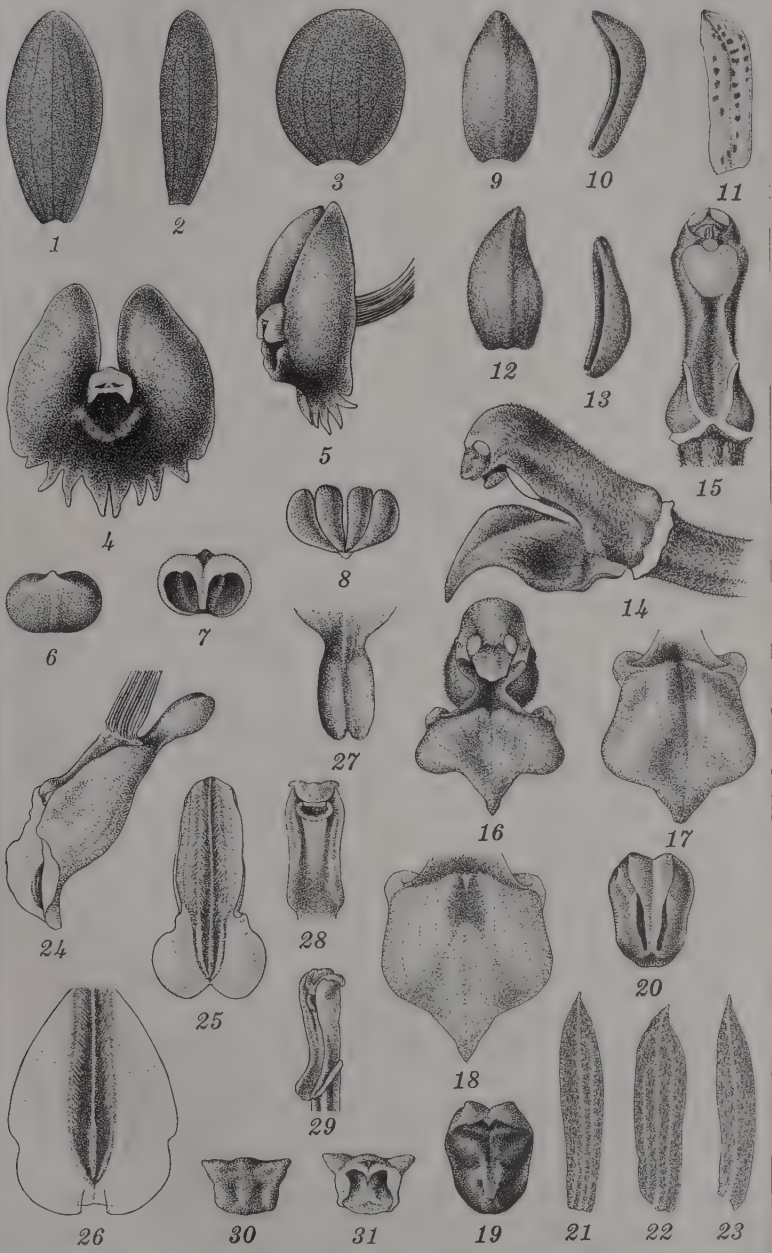
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PLATE 2.

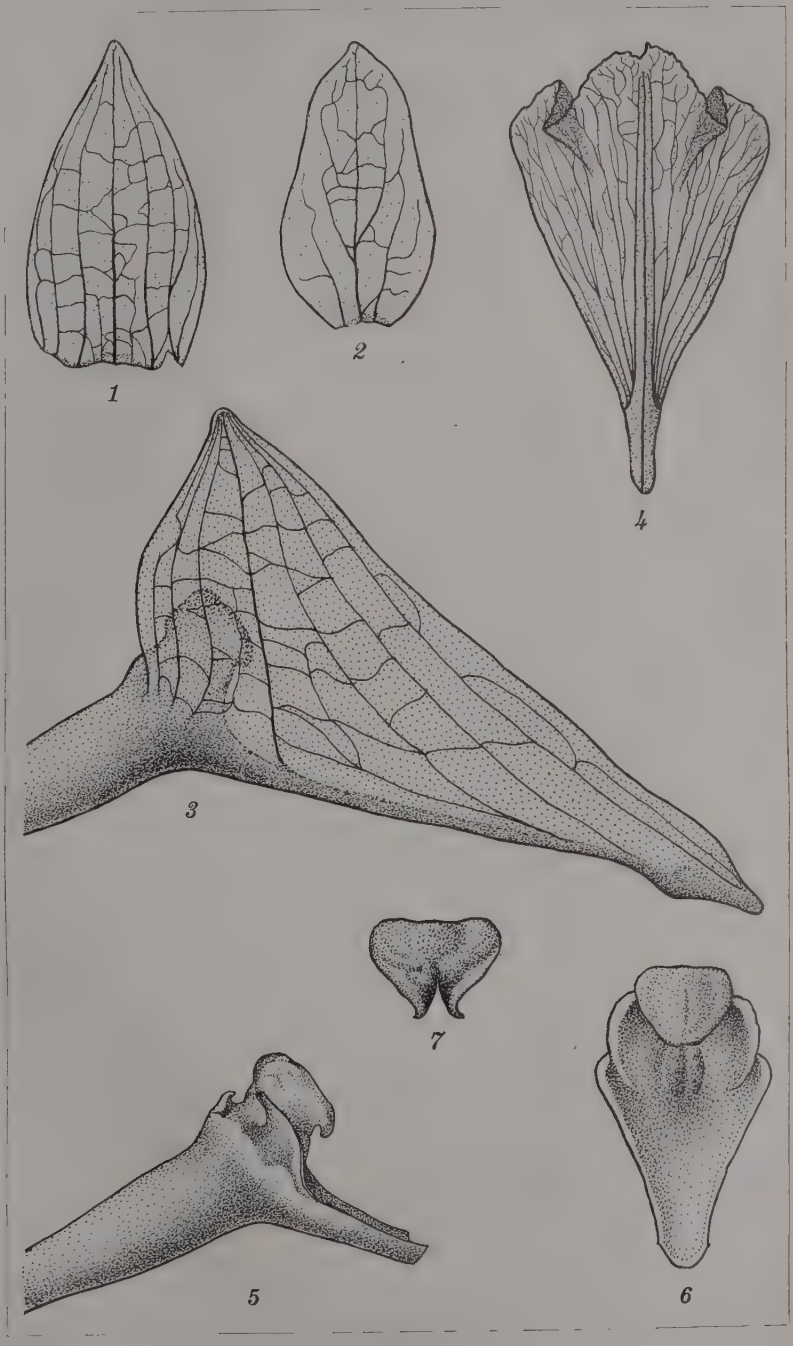

PLATE 3.

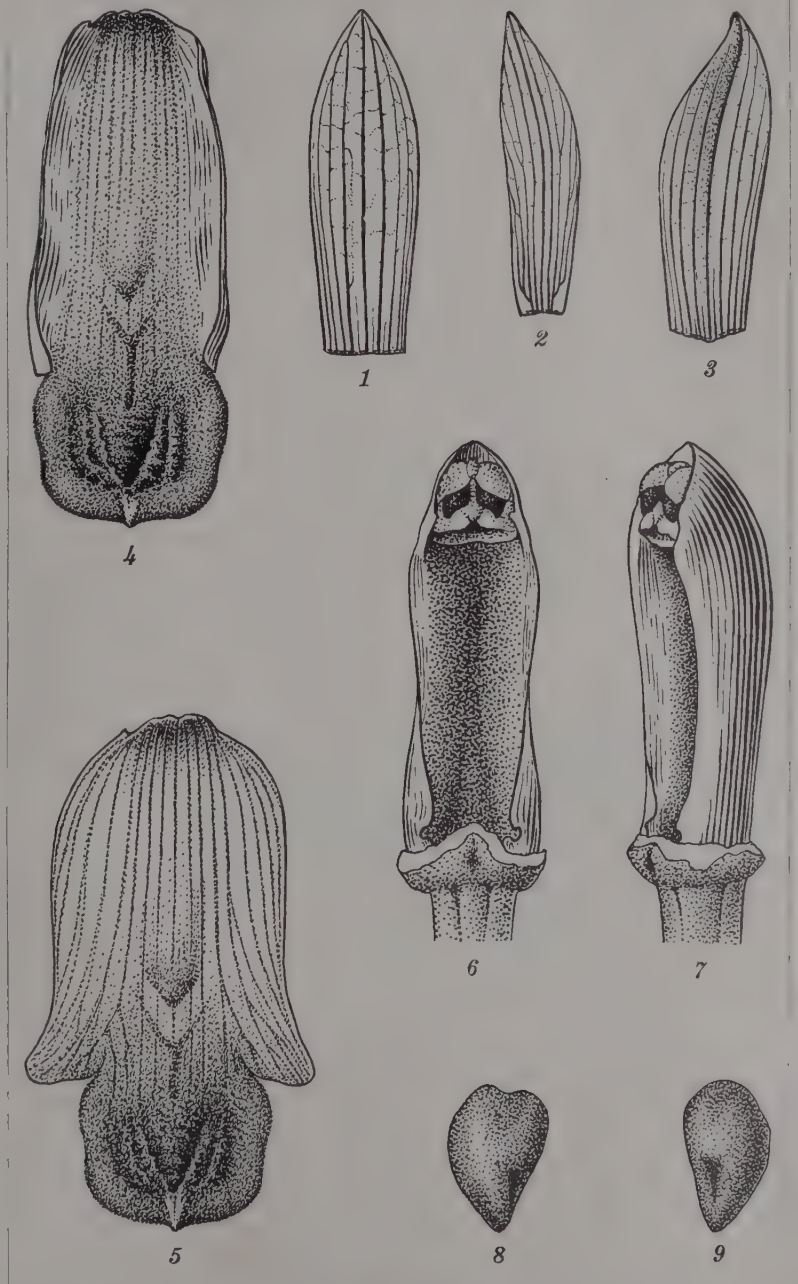

PLATE 4.

PLATE 5.

PLATE 6.

PLATE 7.

PLATE 8.

PLATE 9.

A PRACTICAL ILLUSTRATED KEY TO ADULTS OF PHILIPPINE ANOPHELES [1]

By Paul F. Russell

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and

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THIRTY-FOUR PLATES AND SIX TEXT FIGURES

INTRODUCTION

The authors wish to emphasize the fact that this key is not presented as a research study in entomology, but as a practical aid to malaria studies in the Philippines. No key to the local adult anophelines has been printed, and the need for one is great. This key is subject to revision, as there remains a considerable amount of systematic study to be done, especially on eggs and pupæ. Our key is original in that every drawing is a new one made directly from specimens collected by us or reared and prepared in our laboratory. Our key is based on the work of many authors who have published their observations regarding the local anophelines.

The papers by Ludlow,(1) Banks,(2) Mieldazis,(3) Manalang,(4) Baisas,(5) and King(6) have been of special importance

[1] The senior author formerly was chief of Malaria Investigations which was jointly supported by the Bureau of Science, Manila, and the International Health Division of The Rockefeller Foundation. The junior author has been detailed to Malaria Investigations by courtesy of Dr. J. Fajardo, director, Philippine Bureau of Health. We are indebted to the following for assistance at various times during the year in which we have been preparing this paper: Messrs. Andres M. Nono and Domingo Santiago, Miss Amparo Capistrano, and Mrs. Isabel V. Ramos, all of the staff of Malaria Investigations. All of the drawings are original and were prepared from specimens caught or reared by the staff of Malaria Investigations. We are indebted to the artists, Messrs. Eliseo Enriquez and Alejandro Rosario, for their painstaking work. We would also acknowledge the work of the photographic section of the Bureau of Science for painstaking care with many of the plates, not only of this paper but also of our larval key.

in developing our knowledge of Philippine *Anopheles*. Recent comprehensive publications by Edwards(7) and Christophers(8) have been very useful. The latter(8) gives numerous references to papers by various authors regarding wing venation, male genitalia, and other characters. Soesilo and van Hell(9) have recently revised Rodenwaldt's chart of the *Anopheles* of the Netherlands Indies. It contains certain forms also found in the Philippines. Russell(10) gives a complete bibliography, as regards the Philippines, of publications relating to mosquitoes and malaria from 1898 to 1933.

In using a key to mosquito species it should be remembered that there is often individual variation. Therefore, more than one character should be used. Habitat will sometimes be of help. If there remains any doubt about diagnosis the insect should be sent to the malaria control section of the Bureau of Health, Manila.

DESCRIPTION OF CHARACTERS USED IN SEPARATING ANOPHELES ADULTS

A. SIZE AND COLOR

Species differ in size and color. This fact may sometimes be of use in classification, although not often. Size may be judged by wing length. Anophelines of average size have wings from 4 to 4.5 millimeters in length. Small species have wings measuring about 3 millimeters, and large species about 5 to 6 millimeters.

Colors vary from light gray to dark brown or almost black. Individuals of the same species, however, may vary. Occasionally the dark markings are abnormally increased or decreased. If increased, the condition is called "melanism." If decreased, it is called "hypomelanism." In our description of species we have indicated the cases in which coloration or size is of use for practical identification purposes.

B. THE HEAD

The typical head parts—namely, antennæ, clypeus, palpi, labium or proboscis with its labella, mandibles and maxillæ, vertex and vertical tuft—are shown in text fig. 1. These structures should be known to one who is interested in the identification of mosquitoes.

The male has markedly plumose or feathery antennæ. These differences and also those between male and female palpi are

FIG. 1. *Anopheles maculatus* Theobald; head parts; *1*, palp; *2*, proboscis; *lb*, labella; *a*, antenna; *c*, clypeus; *lr*, tip of labium-epipharynx; *mb*, mandible; *mx*, maxilla; *v*, vertex; *vt*, vertical tuft; *e*, eye. (Camera-lucida drawing, semidiagrammatic.)

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shown in text fig. 1. The ratio between the length of segment 5 and that of 4 in the female gives the "palpal index," which varies from 1:3 to 1:7 in different species. In the male segments 4 and 5 are expanded and somewhat flattened.

The ornamentation of the palpi is sometimes of importance in differentiating species. It consists of bands of pale scales. These bands vary in width and arrangement. There may be three or four bands, located at the apex and at joint 3–4 and 2–3. If the apical segment is short it usually presents only one band, but if it is long it may present two.

C. THE PHARYNX

We have not used pharyngeal characters, or the so-called "buccopharyngeal armature," in our key; but this microscopical structure has considerable value and has been studied by several investigators. For further information Sinton and Covell,(11) Barraud and Covell,(12) and Christophers(8) should be consulted. For Philippine species see Manalang.(13)

D. THE THORAX

The thorax (text fig. 2) consists of three parts; namely, the prothorax, the mesothorax, and the metathorax. The mesothorax forms most of the clearly visible thorax and its dorsal or upper side is called the "mesonotum." Text fig. 2 shows also the anterior pronotal lobe, the pleura and propleural hairs, and the scutellum.

For more details regarding the thorax, Christophers(8) should be consulted. The mesonotum may have hairs, hairlike scales, or true scales, or it may be bare and shiny. The character of the fossa of the mesonotum may be of value. It may or may not have broad flat scales, and the number of these scales may vary.

E. THE WINGS

The characters of the wings of *Anopheles* are very important in differentiating species, and one should be thoroughly familiar with these structures. The essential characters are shown diagrammatically in text fig. 3. The venation is shown in the upper part of this text figure. The "longitudinal veins" are numbered 1 to 6. Some of the veins have two branches. These are known as "anterior" and "posterior" branches, the anterior being nearer the head when the wings are spread. In the diagram, for example, longitudinal vein 2 has two branches,

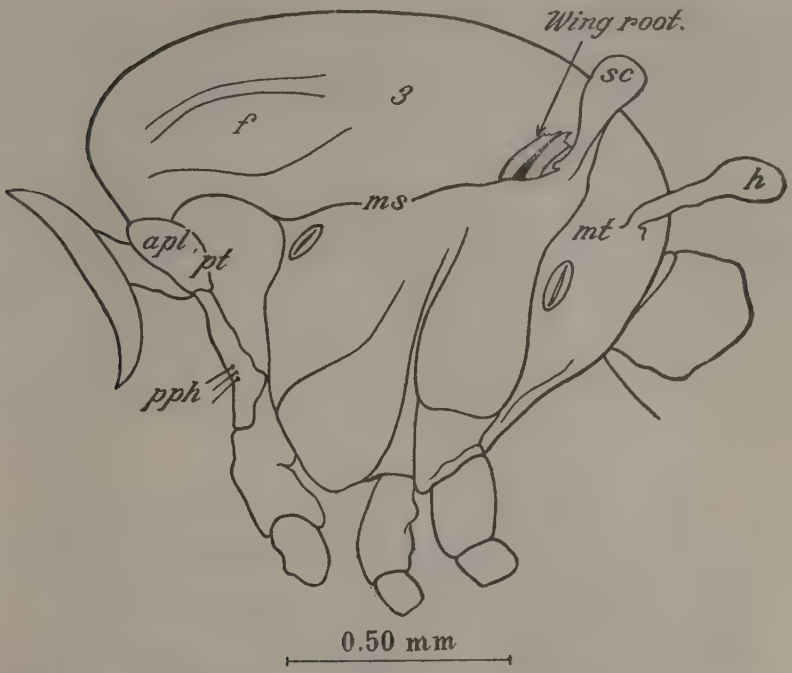

FIG. 2. *Anopheles maculatus* Theobald; thorax; *pt*, prothorax; *ms*, mesothorax; *mt*, metathorax; *3*, mesonotum; *apl*, anterior pronotal lobe; *pph*, propleural hairs; *sc*, scutellum; *h*, halteres; *f*, fossa. (Camera-lucida drawing, semidiagrammatic.)

numbered 2.1 and 2.2, anterior and posterior, respectively. There are also some "crossveins," as illustrated. Other essential parts of the wing are shown. These are *a*, the apex; *b*, the base; *C*, the costa; *Sc*, the subcosta; *f*, the fringe; *hv*, the humeral crossvein; *cv*, 2–3, crossvein between vein 2 and vein 3 (other crossveins are similarly named); *af*, the anterior forked cell; *pf*, the posterior forked cell.

The petiole of the anterior or posterior forked cells is that part of the main vein from the bifurcation, which forms the cell, to the crossvein. For instance, the petiole of the posterior forked cell extends from crossvein 3–4 to the bifurcation of vein 4. In separating *Anopheles leucosphyrus* from *A. near-leucosphyrus* in our key, we have used the following index:

$$\frac{\text{Length of petiole of posterior forked cell.}}{\text{Length of 4.2.}}$$

We have called this the "posterior petiole index" for convenience. It is not the same as the "forked-cell index," which

is obtained by dividing the length of 2.2 by that of 4.2. Some authors have used also an anterior petiole index. These indices vary considerably in the same species, but the one we have used seems to have real value in separating *A. leucosphyrus* from *A.* near-*leucosphyrus*.

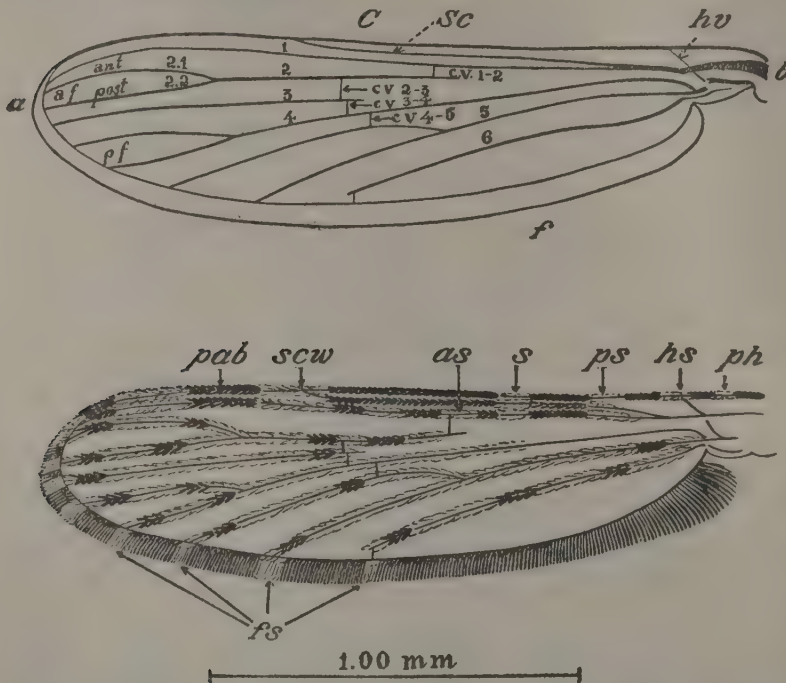

FIG. 3. *Anopheles maculatus* Theobald; wing; upper figure shows venation; lower figure shows ornamentation. *a*, Apex; *b*, base; *C*, costa; *Sc*, subcosta; *f*, fringe; *1* to *6*, longitudinal veins; *2.1*, anterior branch of second longitudinal vein; *2.2* posterior branch of second longitudinal vein; *cv*, crossveins; *hv*, humeral crossvein; *af*, anterior forked cell; *pf*, posterior forked cell; *ph*, prehumeral white spot; *hs*, humeral spot; *ps*, presector spot; *s*, sector spot; *as*, accessory sector spot; *pab*, preapical black spot; *scw*, subcostal white spot; *fs*, fringe spots. (Camera-lucida drawing, semidiagrammatic.)

The coloration or ornamentation of the wing is due to wing scales, the general arrangement of which is shown in the lower part of text fig. 3. The pale parts, whenever sufficiently compact and of such size as to be well demarcated from the surrounding dark portions, are usually referred to as "pale spots," "pale areas," or "pale patches;" the word "pale" being replaced with "dark" when reference is made to the dark parts on pale background or surrounding. Such a constantly pale area, however, as the subcostal pale spot, is merely called "subcostal spot." The markings on the male may be less vivid than those on the female.

F. THE LEGS

The legs of a mosquito are also important in the identification of species. The essential parts for this purpose are shown in text fig. 4. The coxa articulates with the thorax. Below the coxa come the trochanter, the femur, the tibia, and the tarsus in that order. The tarsus consists of five segments. The coxæ may or may not be devoid of scales, but the other segments are scaled (except occasionally the trochanters of the hind or middle legs). The femora may be pale at the trochanter end. Both the femora and the tibiæ may be pale at their distal ends. Such paleness constitutes what is sometimes called a "knee spot." The femora, tibiæ, and tarsi may have irregular rings of pale scaling, in which case they are sometimes referred to as being "speckled."

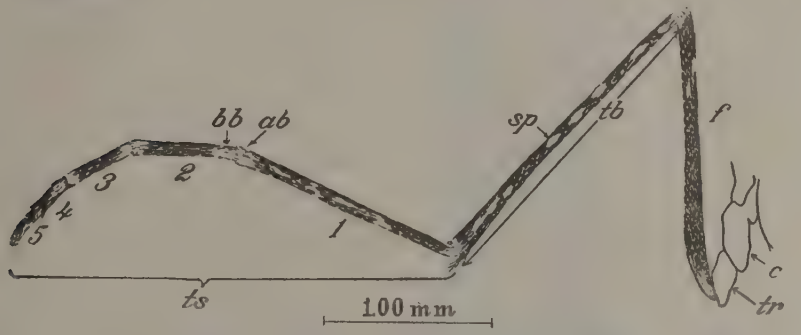

FIG. 4. *Anopheles maculatus* Theobald: foreleg; *c*, coxa; *tr*, trochanter; *f*, femur; *tb*, tibia; *ts*, tarsal segments; *ab*, apical band; *bb*, basal band. (Camera-lucida drawing, semidiagrammatic.)

The tarsal segments frequently carry the most useful ornamentation for diagnostic purposes. They may be entirely dark or they may carry pale bands. These bands may be only at the lower tips, in which case they are "apical," or they may be both "apical" and "basal," in which case they spread across the joints. Sometimes the last one, two, or three segments of the tarsus of the hind leg are completely white.

Each foreleg has a single large claw at its tip. The claw has a spur located midway and a smaller projection near the base. These processes are called the "male ungues" and are typical of all Anophelini, with minor variations. In both male and female the midlegs and hind legs are each provided with a pair of small hooks.

G. THE ABDOMEN

The scaling of the abdomen is sometimes useful in classifying Anophelini (text fig. 5). There are eight visible segments. The upper surface is usually called the "dorsum" and the dorsal portions of the segments are called tergites. The undersurface is the "ventrum," and the segments are "sternites." The male terminalia including segment VIII rotates 180° soon after emergence of the adult mosquito from the pupal cast so that the anatomically dorsal portion of these parts becomes ventral, and vice versa.

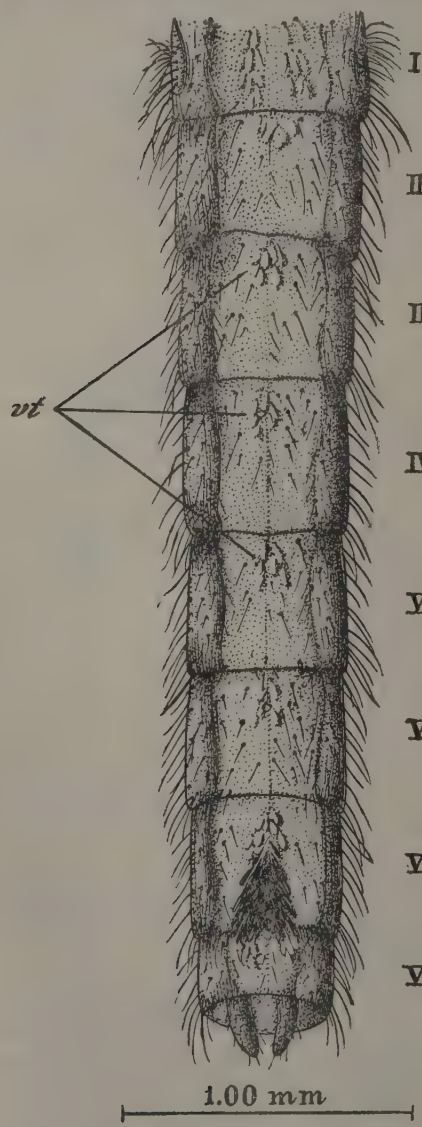

FIG. 5. *Anopheles pseudobarbirostris* Ludlow; abdomen, segments I to VIII; *vt*, ventral tufts. (Camera-lucida drawing, semidiagrammatic.)

H. THE HYPOPYGIUM, OR TERMINALIA

The terminal part of the abdomen beyond segment VIII is called the "hypopygium" or "terminalia." This structure in the male has important characters for identification purposes (text fig. 6). One should learn to recognize the following parts:

Proctiger, or anal lobe.—The anal lobe is largely membranous.

Coxites, or side pieces.—The coxites are conically cylindrical.

Styles, or claspers.—The styles are long processes attached to the coxites and terminating in small spurlike appendages.

Parabasal spines.—There are two of these spines on each side in the subgenus *Anopheles,* as a rule. In *Myzomyia* there are usually five smaller spines or hairs.

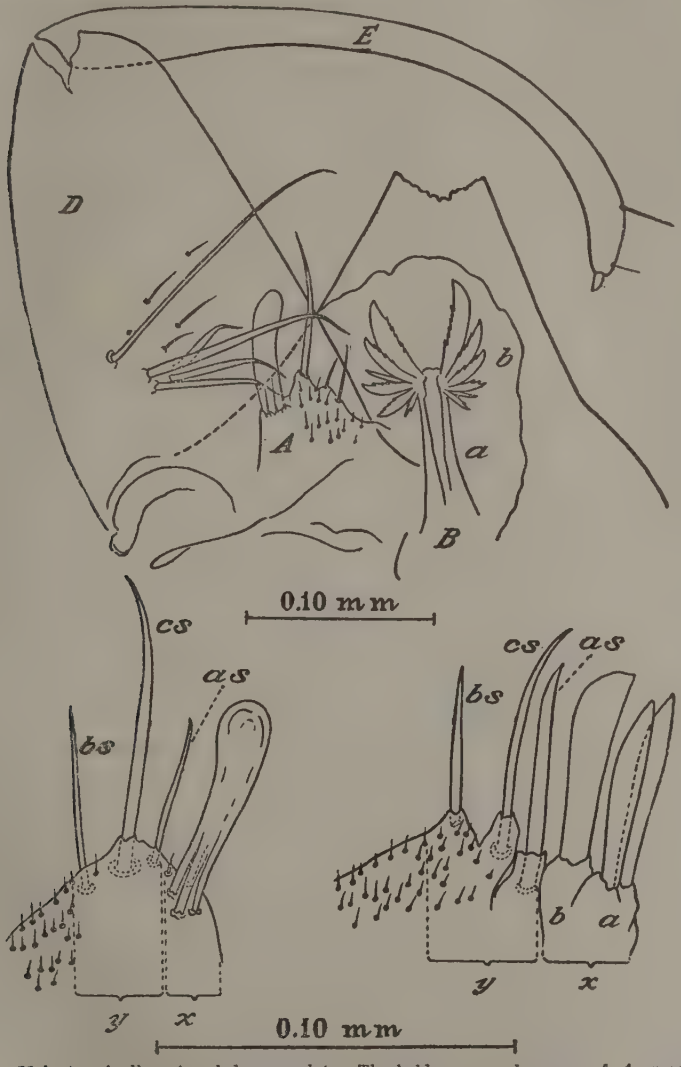

FIG. 6. Male terminalia; *Anopheles maculatus* Theobald, upper; harpago of *A. maculatus* Theo., lower left; harpago of *A. aitkeni* var. *bengalensis* Puri, lower right. *A,* harpago; *x,* dorsal lobe; *y,* ventral lobe; *a,* external; *b,* internal; *as,* external spine; *bs,* internal spine; *cs,* apical spine; *B,* phallosome; *a,* stem; *b,* leaflets; *D,* coxite; *E,* style. (Camera-lucida drawing, semidiagrammatic.)

Internal spines.—One or two spines on each side arise from the inner edge of the coxites.

Harpagos.—The harpagos are lobe-shaped processes, one on the inner side of each coxite near its base. In the subgenus *Myzomyia* the harpago is usually rounded or conical, clubbed dorsally, and has an "apical hair" and one or more smaller accessory hairs. In the subgenus *Anopheles* the crest of the harpago is frequently lobate, each lobe has short spines, and those on the dorsal lobe are fused into a clublike process. The harpago, following Christophers's (1933) latest designation of parts, has two lobes as follows:

The dorsal lobe of the harpago.—In *Anopheles aitkeni* var. *bengalensis* and in *A. insulæflorum* two parts may be distinguished; namely, the external, ventral lobe of Puri (1930), and the internal. Each bears much flattened spines. Those of the external part are usually not fused, but may sometimes be imperfectly fused apically either with each other or with those of the internal part. The internal part may bear one or two well-fused spines, much flattened and rounded like a club towards the apex. In all other species the parts representing the external and the internal portions are hard to distinguish. This is particularly true in subgenus *Myzomyia.* For purely diagnostic purposes, however, it is not necessary to differentiate the parts, except in the two species named above.

The ventral lobe of the harpago.—It is difficult to distinguish the demarcations between the parts of the ventral lobe even in *A. aitkeni* var. *bengalensis* and in *A. insulæflorum* in which they are supposed to be best shown. For simplicity and convenience we shall merely refer to the spines it bears as follows: The one on top of the prominence, typically the longest in all species except *insulæflorum,* the "apical spine;" the one or ones between it and those of the dorsal lobe, the "external spines," and the one or ones towards the inner side, the "internal spines" (text fig. 6).

The harpago varies a great deal in many species. The dorsal lobe (Christophers, 1933), except in *A. aitkeni* var. *bengalensis, gigas* var. *formosus, insulæflorum, lindesayi* var. *benguetensis,* and *pseudobarbirostris,* typically bears a club, which is a fusion of several flattened spines. In some individuals, however, the fusion is complete on one side and not on the other; in others the club is duplicated; and in still others there is a secondary club. Generally the spines of the ventral lobe follow a certain subgeneric, and sometimes specific, pattern. The apical spine may sometimes be branched or doubled; the inner spine

may be absent, in which case it is usually replaced by a mark; when present, it may be far removed from its usual position or more than the usual number may appear. Likewise, the external spine varies as to number, size, and length. Sometimes it is flattened like a blade; or else it may assume the form of a small club. *Anopheles philippinensis* seems to have the most variable harpago. In no two individuals we dissected were the harpagos alike, and in only one mosquito were they exactly alike on both sides.

Phallosome, or mesosome.—This single process lies between the two harpagos. Its apex may be bare; most frequently it has from three to more than ten leaflets extending from each side. These leaflets may or may not be serrated on one or both sides.

We have dissected as many male terminalia as our collections permit. To note variations we included in each species, whenever available, individuals from different islands and from different altitudes.

We realize that the average field worker may not be able to use the male terminalia in his routine identifications, so we have based our key on other characters wherever possible. Only in the case of *Anopheles aitkeni* var. *bengalensis* and *A. insulæflorum* has it been necessary to rely on the male characters. Fortunately these two species are not very common or important. We would recommend, however, that anyone seriously interested in *Anopheles* should try to learn how to mount and identify the male terminalia. The female hypopygium is not used in classification (Christophers, 1933).(8) Christophers also gives a good account of the technic of preparing mosquitoes for identification.

In the illustrations numbers and letters indicate structures as follows:

1, Palp.
2, Proboscis.
3, Mesonotum.
4, Wing.
5, Leg.
  a, Foreleg.
  b, Midleg.
  c, Hind leg.
6, Abdomen.
  a, Dorsal
  b, Ventral.
7, Terminalia.
  A, Harpago.
    x, Dorsal lobe.
      a, External part.
      b, Internal part.
    y, Ventral lobe.
      as, External spine.
      bs, Internal spine.
      cs, Apical spine.

7, Terminalia—Continued.
B, Phallosome.
a, Stem.
b, Leaflets.
C, Process of ninth segment.
7, Terminalia—Continued.
D, Coxite.
a, Expanded organ on side of coxite.
E, Style.

TECHNIC

The subject of technic requires so much consideration that we have prepared a separate paper on this subject.(14) Here we simply emphasize that mosquitoes are fragile and must be handled carefully. Rough treatment will cause important structures, such as hairs and scales, not to mention legs and wings, to rub off and thus may interfere seriously with identification.

LIST OF PHILIPPINE ANOPHELES

In our recently published key to larvæ of Philippine *Anopheles* we gave as complete a synoptic table of local anophelines as possible. Therefore, in this paper we shall merely give a list of the Philippine species as at present classified.

For lack of specimens from certain type localities, with which to compare our own, we use provisionally certain names. Thus we designate one of our species *insulæflorum*, although it seems to differ in at least one respect from the Indian species of that name. Christophers and others seem to indicate a similarity between the spines of the ventral lobes of the harpagos of *aitkeni* var. *bengalensis* and *insulæflorum;* at least, no difference in this structure between the two species has been mentioned or illustrated. In what we call *insulæflorum* in this paper, the spines on the ventral lobe of the harpago are much shorter and less flattened than those of var. *bengalensis*.

The value of direct comparison is obvious. The specimens of Indian *Anopheles barbirostris* and *maculatus* we received from Doctor Barraud illustrate the point we want to bring out. The female Indian *barbirostris* (two have the abdomen intact) shows very definitely the scattered white scales on the ventral aspect of the abdomen. These are even more conspicuous than the ventral white scale tufts of the Philippine *pseudobarbirostris*. We have not seen a single Philippine *barbirostris* of this type. In the few cases where the ventral scales are present, the scales are long, curved, and narrow, and yellowish in tinge rather than white. The Indian *maculatus* sent to us also bears very much more numerous and broader scales than any found in the Philippines. Abdominal tergite II as illustrated in Plate 24 will serve to show the contrast between the Philippine

and the Indian forms. This is only one of the forms found in India.

So, too, we cannot be certain about *A. baezai* Gater. The name is used merely for convenience and in accordance with the purpose for which this paper is intended.

Our list of Philippine *Anopheles* is as follows:

Tribe ANOPHELINI

Genus ANOPHELES

Subgenus ANOPHELES

1. *Anopheles aitkeni* var. *bengalensis* Puri, 1930.
2. *Anopheles gigas* var. *formosus* Ludlow, 1909.
3. *Anopheles insulæflorum* Swellengrebel and Swellengrebel de Graaf, 1920.
4. *Anopheles lindesayi* var. *benguetensis* King, 1931.
5. *Anopheles baezai* Gater, 1933 (?). Perhaps a variety of the true *baezai*, or else a distinct species.
6. *Anopheles barbirostris* van der Wulp, 1884.
7. *Anopheles hyrcanus* var. *nigerrimus* Giles, 1900.
8. *Anopheles hyrcanus* var. *sinensis* Wiedemann, 1828.
9. *Anopheles pseudobarbirostris* Ludlow, 1902.

Subgenus MYZOMYIA

10. *Anopheles kochi* Dönitz, 1901.
11. *Anopheles kolambuganensis* Baisas, 1931.
12. *Anopheles leucosphyrus* Dönitz, 1901.
13. *Anopheles tessellatus* Theobald, 1901.
14. *Anopheles filipinæ* Manalang, 1930.
15. *Anopheles mangyanus* Banks, 1907.
16. *Anopheles minimus* var. *flavirostris* Ludlow, 1914.
17. *Anopheles litoralis* King, 1932.
18. *Anopheles ludlowi* Theobald, 1903.
19. *Anopheles parangensis* Ludlow, 1914.
20. *Anopheles subpictus* var. *indefinitus* Ludlow, 1904.
21. *Anopheles vagus* var. *limosus* King, 1932.
22. *Anopheles annularis* van der Wulp, 1884. *Anopheles fuliginosus* Giles, 1900.
23. *Anopheles karwari* James, 1903.
24. *Anopheles maculatus* Theobald, 1901.
25. *Anopheles philippinensis* Ludlow, 1902.

We have included also three undetermined anophelines, as follows:

26. *Anopheles* of undetermined species or variety (?).

    From Balabac, Palawan, collected in 1933 by P. F. Russell and A. M. Nono. This form has lately been taken also in Iwahig, Palawan. It may prove to be a geographic variety of *leucosphyrus*.

27. *Anopheles* near-*leucosphyrus* King.

    Taken in Mindanao by F. E. Baisas and D. Santiago.

28. *Anopheles* belonging to *aitkeni* group.

    Taken on Mount Banahao, Luzon, by F. E. Baisas and D. Santiago. No adult is known.

DESCRIPTIVE NOTES

1. ANOPHELES AITKENI var. BENGALENSIS Puri, 1930. Plate 1.

Medium-sized, dark, *Culex*-like at rest.

Palpi of female slender, dark, slightly swollen apically. Palpi of male slender, dark, clubbed as usual. This club is light and shiny when devoid of scales. Normally, the scales do not entirely cover the club and the spaces between them give an effect of white patches under certain light.

Proboscis dark up to labella.

Wings entirely dark, with narrower scales than other species.

Legs slender and entirely dark.

Abdomen dark dorsally and ventrally; no scales even on cerci and coxites.

Male terminalia: Harpago with external portion (*a*) of dorsal lobe (ventral lobe of Christophers, 1915, and Puri, 1930) with two broad spines; the inner with a still broader spine, which in some appears to be a fusion of two spines. Phallosome devoid of leaflets and spinous processes.

2. ANOPHELES GIGAS var. FORMOSUS Ludlow, 1909. Plate 2.

Largest Philippine *Anopheles*. Pale in appearance because of wide yellowish areas on wing. Anopheline attitude at rest.

Palpi of female with tip of segment 5 pale; pale rings at joints 4–5, 3–4, and some pale scales at 2–3. Palpi of male with segment 2 dark, a wide pale band at 2–3; 3 dark subbasally up to about one-third or one-half, rest mainly pale up to apex, but appearing dark under certain light; 4 and 5 mainly pale, with indefinite dark patches at about middle or base.

Proboscis dark, except labella.

Wings broad, with conspicuous pale spots; costal spots long, especially presector and subcostal; sector and preapical spots absent; pale area at middle of vein 2.1 and fringe spot between 5.2 and 6 sometimes absent.

Legs with fore femora much lighter in hue than mid- and hind femora, all with few white scales at apices and conspicuous yellow band at bases. Tibiæ dark with pale apices, apex of hind tibia more conspicuous; hind tibia with a distinct yellow spot at base on underside, appearing like a subbasal spot when viewed laterally. Fore tarsi with apical bands on 1 and 2 and often 3; pale basal bands on 1, 2, 3, and, usually, 5; midtibia with pale patches on apices of 1, 2, 3, and, less often, 4; hind tibia with more or less distinct apical and basal bands on 1 to 4; 5 often with a pale patch basally.

Abdomen pale and devoid of scales, even on cerci, but coxites with numerous long and broad scales along external borders.

Male terminalia: Process of segment IX very vestigial, unlike those of other species of this subgenus. External portion of dorsal lobe of harpago with three or four flattened spines; internal portion with one flattened spine longer than those of the external; ventral lobe with three spines, the apical the longest and sometimes duplicated; usually two external spines, one of which may be very short or absent; no internal spines. Phallosome with five to seven, relatively narrow, serrated leaflets on each side.

3. ANOPHELES INSULÆFLORUM Swellengrebel and Swellengrebel de Graaf, 1920. Plate 3.

Merium-sized, dark, *Culex*-like at rest. Indistinguishable from *aitkeni* var. *bengalensis* except by larval and genitalic characters. (Both species are uncommon. They may sometimes be found in the same forest stream, but as a rule *aitkeni* prefers the upper parts of the streams. We have not taken them from the same place.)

Male terminalia: The male of *insulæflorum* is easily differentiated from that of *bengalensis* by the spicular processes on the phallosome and also by the spines of the ventral lobe of the harpago. Dorsal lobe of harpago externally bears two or three flattened spines which in Philippine specimens tend to assume various forms. In one specimen they are fused apically with the internal spines. Internally the dorsal lobe bears a much-flattened clublike process. Ventral lobe with external spine much shorter than club; often narrower, and much shorter than that of *bengalensis*. Middle still shorter; internal longer than external but shorter than club.

4. ANOPHELES LINDESAYI var. BENGUETENSIS King, 1931. Plate 4.

Fairly large and dark. Peculiar in having a broad white band at about the middle of hind femur.

Palpi entirely dark.

Proboscis dark.

Wings extensively dark; costa, subcosta, and vein 1 dark except for apical pale spot; pale spots at tips of veins 4.2, 5.2, and 6; usually pale fringe spots opposite apices of these veins, but not always.

Legs with fore and midfemora white-ringed at bases; hind femora with wider but variable pale area dorsally and ven-

trally; a conspicuous white band near middle. Tarsi with all segments dark.

Abdomen dark, devoid of scales even on cerci, but some present on external borders of coxites.

Male terminalia: Dorsal lobe of harpago with three unfused broad spines, broadest toward apices; ventral lobe with apical spine longer than club; one internal spine, about as long as club or longer; no external spine. Phallosome with eighteen or nineteen narrow leaflets on each side, some with serrations, and one or two cleft at apices.

5. ANOPHELES BAEZAI Gater, 1933. Plate 5.

Fairly large and dark. Anopheline attitude, but not so marked as in *A. barbirostris*. (Reported southward from Camarines Norte to Mindanao and Palawan. Formerly locally reported as *umbrosus*. In a personal communication, Gater, after examining some of our specimens, writes that it may be a variant which he has referred to as "Form A." According to him the *umbrosus* group is still very confused. Certainly the species we are describing is not typical *umbrosus*, and until the present species *baezai* is further divided we prefer to use the name *baezai*.

Palpi shaggy and entirely dark.

Proboscis dark, except for labella.

Head with vertical tuft and anterior vertex white; rest of head black-scaled.

Thorax dark; mesonotum devoid of scales except for a few narrow dark ones at the anterior border; pleura without scales. *Apl* with a group of broad flat scales on upper portion, and scattered bristles all over. Propleural hairs present.

Wings mostly dark anteriorly; costa entirely dark except for the subcostal and subapical pale spots. The subcostal spot does not involve vein 1 in the female but involves the anterior side of that vein in the male. The preapical spot involves the apex of vein 1 and continues to vein 2.1, where it forms a subapical pale area. Aside from an apical white spot, vein 1 has a few white scales or a complete pale patch near the origin of vein 2. Vein 2.2 dark with a subbasal pale area; stem of 2 usually with two dark patches towards the basal two-thirds, which are sometimes contiguous, the rest with an admixture of black and white scales. Vein 3 with a basal black area, remaining portion pale with scattered black scales on lateral squames. Vein 4.1 pale with a few black scales near point of origin; 4.2 with apex and

base black. Vein 5.1 with apical and subbasal dark patches, the rest often with scattered black scales. One or two dark scales may be present at point of bifurcation. Vein 5.2 black apically, pale towards base which at times has scattered black scales. Stem mostly black towards base; whitish towards apex. Vein 6 with apical and middle black areas, the base entirely pale. Only one fringe spot, situated at apex of 2.2, continuous to opposite 3. Fringe opposite 1–2.1 dark. Humeral crossvein with some dark scales. Remigium entirely dark-scaled. The wing marking of the male varies somewhat from that of the female due to more scanty scales and more liberal distribution of pale ones.

Legs entirely dark with some white scales at the apices of femora and tibiæ, and sometimes one or two pale ones at the apices of some of the tarsal segments.

Abdomen black dorsally and ventrally without scales even on cerci, but coxites with long scales along the external borders.

Male terminalia with process of segment IX developed, but not as long as that of *hyrcanus*. Dorsal lobe of harpago carries a club; ventral lobe with the apical spine much longer than the club; external spine shorter than the apical but longer than the club; no internal spines. Phallosome normal, with fairly long, broad, usually unserrated leaflets; five to six leaflets of uniformly decreasing size on either side.

6. ANOPHELES BARBIROSTRIS van der Wulp, 1884. Plate 6.

Large and black, with distinctly anopheline attitude. Of all *Anopheles* it forms the greatest angle with the surface on which it rests.

Palpi of female shaggy and entirely dark. Palpi of male black with an apical white ring on outward aspect on segments 3 and 4. No specimen we have examined has had the ring absent on 4 and only rarely on 3. In *barbirostris*, as in some other species, the male palps show different hues when viewed at different angles under the same light. The predominating one in various positions is considered the true character.

Proboscis entirely dark, except labella.

Wings with an admixture of pure white and black scales; black scales on humeral vein. Unlike *baezai*, the basal third of the costa together with that portion under it of the subcosta and of vein 1 have scattered pale scales; and one, two, or several pale scales often interrupt the continuity of black on the humeral and prehumeral areas of costa. Apical white involves tip of veins 1 and 2.1. Vein 2.2 has white preapical pale area (some-

times purely pale, sometimes with scattered black scales) aside from a subbasal pale patch. Fringe spots opposite apices of 2.1 and 3 and usually opposite 5.2. That opposite 3 may extend to opposite 4.1. Again, unlike *baezai, barbirostris* has the stem of 2 entirely black and there are scattered black scales at the basal portion of 6. Remigium covered with dark and pale scales; the pale scales sometimes covering basal part, sometimes in a cluster at the middle, or merely scattered among the dark scales. Less obvious differences are shown on Plates 5 and 6.

Legs with the femora dark above, pale beneath towards the base; an indefinite pale ring at the base. Tibiæ with some pale scales at the apices. Fore tarsi dark, with narrow pale rings on apices of 1 and 2 and sometimes also on 3; midtarsi with a few pale scales on apices of 1 and 2; hind tarsi with narrow pale rings at apices of 1 to 4.

Abdomen dark; tergites devoid of scales; sternites usually also without scales except on VIII of males and VII of females where a tuft of scales is present. In males, segment VIII together with the terminalia has been rotated 180° so that the tuft appears to be on the dorsal aspect. In females the tuft is usually composed entirely of dark scales, but a few pale scales may be found mixed with them. Sometimes a few narrow yellowish scales are present on some other sternites, but they are never as conspicuous or numerous as those found in *barbirostris* from India. Female cerci devoid of scales; male coxites with many scales along external borders.

Male terminalia with the process of segment IX developed as in *baezai*. Dorsal lobe of harpago carries a club, invariably well fused; ventral lobe with apical spine much longer than club; external spine a little shorter than apical and longer than club. Phallosome with four or five, rarely six, long leaflets on each side; three or more, including the longest, are serrated on both sides, the rest on one side only.

7. ANOPHELES HYRCANUS var. NIGERRIMUS Giles, 1900. Plate 7.

Fairly large and dark with markedly anopheline attitude at rest. Noticeable because of its size and conspicuous banding of legs.

Palpi of female shaggy; black, with some scattered pale scales, aside from the rings at 2–3, 3–4, and 4–5; base and apex of 5 pale, forming subapical (4–5) and apical rings, respectively. Palpi of male with a line of white scales on the upper surface, usually running throughout entire length of 2,

its apex being white; 3 with scattered white scales, and white at apex; basal two-thirds or more of 4 light or golden (very deceptive when viewed at different angles under the same light), with a subapical dark and an apical white ring; 5 all white except outer margin and usually a narrow dark area at base.

Proboscis dark, except labella.

Wings differ from those of *barbirostris* as follows: Pale fringe spot at tip of wing involves area opposite 2.1, 2.2 to 3; subapical pale costal spot does not involve extreme tips of veins 1 and 2.1; pale scales on basal third of vein 1 and subcosta well scattered and intermixed with the dark ones, unlike those of *barbirostris* in which the pale scales are in clusters forming bandlike interruptions on the line of dark scales; moreover, the scales on this portion of the wing are closely appressed to the veins, and the individual scales are narrower than those of *barbirostris*, which are more expanded and not closely appressed to the veins. In *nigerrimus* there are no scattered dark scales between the dark patches at the apex of vein 5.2 and at the base of its stem; the humeral crossvein is bare, and the remigium has a continuous line of pale scales on the anterior border, but entirely dark or with pale interruptions at the posterior border; sometimes the whole remigium is entirely pale excepting for 1 or 2 dark scales. Fringe spot opposite 5.2 rarely present.

Legs with femore dark, pale beneath (except fore femora, which are pale only towards apices), somewhat posteriorly with some pale scales at apices. Tibiæ dark, often pale beneath. Tarsal segments with white bandings variable in size, but always conspicuous enough for the naked eye. (Numerous specimens caught in Luzon, Mindanao, and Palawan have bandings sufficiently marked for macroscopic recognition.) For tarsi and midtarsi with 1 to 3 widely banded apically; 4 with a narrow ring or a mere pale patch. Hind tarsi, 1 with a narrow apical ring; 2 and 3 broadly banded apically; 4 with both basal and apical bands; 5 banded basally, the extent of white varying from a very narrow ring to half the length of this segment. Sometimes segment 3 has also a basal band.

Male terminalia with the process of segment IX developed and long. Harpago with dorsal lobe carrying a club; not completely fused at times; ventral lobe with apical and external spines longer than club, the apical longer than external. Phallosome leaflets usually five on either side, but may be more or less, a few specimens showing eight, inclusive of the fine spines;

leaflets rather small, the broadest one, and often also the next broadest, with one or two coarse teeth near the apex, forming a peculiar pattern.

This is particularly true of those collected in Cotabato, Mindanao. Those from Luzon have smaller teeth, and on one side of a specimen there are no teeth at all (Plates 7 and 8). The difference indicated by Baisas(5) between the leaflets of *nigerrimus* and *sinensis* is substantiated by our present work, so that for the Philippines at least this may be useful.

Doctor Barraud sent us some adults (all females, apparently caught wild and not bred out) labeled *nigerrimus*. In nine of these, which have the hind legs in good condition, the white markings vary considerably, one showing basal as well as apical banding on hind tarsal segments 3 and 4; five others show the basal band on 4 in varying degree; four have basal banding on 5, in one case covering half of the segment and in another having but a trace of it.

8. ANOPHELES HYRCANUS var. SINENSIS Wiedemann, 1828. Plate 8.

Much like *nigerrimus*, although often somewhat lighter in hue, and smaller. (Those from Baguio are larger generally than those from the lowlands, and are about as dark as *nigerrimus*.)

Palpi of female banded like those of *nigerrimus*, those of Baguio specimens generally better marked than those of lowland specimens; the extent of banding is, however, very variable. Palpi of male like those of *nigerrimus;* males from Baguio usually have a wider basal black patch on 5.

Proboscis dark, except labella.

Wings very similar to, but in general having more scattered pale scales than, those of *nigerrimus;* subcostal spot usually conspicuous and involving the whole or part of vein 1. Specimens from Baguio have comparatively smaller subcostal spot, which in a few cases does not involve vein 1 at all; there are also fewer scattered pale scales elsewhere on the wing veins. Specimens from the lowlands frequently have a distinct pale spot on vein 1 near the origin of vein 2, and less often another spot a little basal to the subcostal spot. Fringe spot opposite 5.2 rarely present; basal black area on vein 5 invariably large. Remigium usually mainly dark-scaled, with a little admixture of pale scales, the anterior border being continuously pale in only a few individuals from Baguio, and pale on apical half and dark on basal part in a few from the lowlands.

Legs with considerably narrower bands than those of *nigerrimus;* none have a basal ring on hind-tarsal segment 4.

Abdomen similar to that of *nigerrimus.*

Male terminalia with process of segment IX developed. Dorsal lobe of harpago carries a club, sometimes imperfectly fused; ventral lobe with apical and external spines longer than club, apical spine longer than external. Phallosome usually with five leaflets on either side, most of which are serrated from near the base upwards on one side, and the largest also serrated near the apex on the other side. One of two male *sinensis* from Hongkong, sent to us by Doctor Jackson, has fewer and coarser serrations on the phallosomal leaflets (Plate 8), but the other approaches the type of Philippine forms.

9. ANOPHELES PSEUDOBARBIROSTRIS Ludlow, 1902. Plate 9.

Large and black; much like *barbirostris* in its anopheline attitude at rest.

Palpi of female shaggy and entirely dark. Palpi of male dark, with pale rings at 2–3, 3–4, and 4–5.

Proboscis dark, including labella.

Wings usually with a fringe spot opposite 5.2; otherwise very similar to wings of *barbirostris.* The fringe spot opposite 4.1, like that of *barbirostris,* varies in size; it may be formed by three or four pale fringe scales or may extend to the edge opposite 3. A narrow fringe spot opposite 4.2 is very rarely present, but we found no individual with a fringe spot opposite 5.1. Humeral crossvein with dark scales. Remigium mainly dark-scaled with about two pale scales at the middle.

Legs dark with scattered white scales on femora and tibiæ, especially numerous on underside of fore femora; pale apices on most of tarsal segments; fifth hind-tarsal segment often has a narrow pale basal ring.

Abdominal tergites dark, devoid of scales; upper surface (really ventral) of VIII in male with some pale scales at about the middle; sternites with white scale tufts on II to VII; that on VII followed by a large black tuft towards posterior border; VIII in female with two distinct groups of white scales, one on either side near the median area. In dried specimens these white scales appear to be part of scale tuft VII, as segment VIII is telescoped into VII. In females, less so in males, there are numerous white scales on the depressed area on either side of the median line on II and a few scattered ones on the other segments (dried specimen).

Male terminalia with process of segment IX like that of *barbirostris*. Harpago with dorsal lobe projecting prominently; carries two to four, usually three, unfused, flattened, somewhat curved, lanceolate spines; ventral lobe with apical and external spines longer than club, the apical longer than external. Sometimes there is a short extra spine between the two spines. Phallosome with two unserrated leaflets, each having a prominent basal tooth; one specimen has three leaflets on one side (Plate 9).

10. ANOPHELES KOCHI Dönitz, 1901. Plate 10.

Medium-sized, rather light (or fawn) colored, with conspicuous hind-tarsal bands. Anopheline attitude at rest.

Palpi of female with some pale scales at middle of outer surface of 2; pale band at 2–3; 3 dark at base and middle, with an intervening subbasal wide pale area; white apically; 4 black at base, golden at middle, and white at apex; 5 dark at base, apical two-thirds golden. Palpi of male with a wide golden area at middle of 2, black basally and apically; unscaled pale area 2–3; 3 black at base followed by wide yellow, and then a dark band; a subapical wide yellow band, the apex black; 4 entirely golden, except sometimes a white patch at base, wide subapical narrow white and apical narrow black bands; 5 entirely golden. Proboscis with apical half golden, a narrow ring or patch of black at apex of labium; basal half dark with golden spots or scattered golden scales.

Wings extensively pale, accessory sector spots forming a wide pale area even in the costa, particularly in female; vein 6 with three dark spots in female, often only two in male; fringe spots opposite apices of all veins and between the forks of 5, and 5.2 and 6.

Legs spotted; fore-tarsal segments 2 and 3 with wide white apical and basal patches on anterior surface, seldom forming complete bands around segment; a similar patch on apex of 1 and on base of 4; apex of 4 often entirely dark, occasionally with a tiny pale patch; midtarsi with narrow pale patches at joints of 1–2, 2–3, and 3–4; hind-tarsal segment 1 with narrow apical ring; 2 with wide apical band, but none on base; others all broadly white-banded apically and basally.

Dorsum of abdomen with narrow golden scales from II to VIII; sometimes a few also on I; the scales mostly towards apex of each segment, becoming more numerous towards posterior segments; ventrally black scale tufts from II to VII. Numerous yellow scales on cerci of females and on coxites of males.

Male terminalia: Dorsal lobe of harpago with a club; ventral with an apical spine a little longer than club; one or two internal slender spines; no external spine. Phallosome short, leaflets small, with few serrations; from six to eight leaflets on either side.

11. ANOPHELES KOLAMBUGANENSIS Baisas, 1931. Plate 11.

Medium-sized, rather pale.

Palpi of female with some white scales at midouter surface of 2; white scales at apex form narrow band on 2–3; 3 with basal half dark, followed by a wide white area and a narrow black area, extreme apex golden; basal third of 4 dark, the rest upwards golden or whitish; base of 5 usually dark, the apex golden; but sometimes this segment is entirely golden. Palpi of male with more numerous white scales at middle and base of 2; narrow pale band at 2–3; a middle indefinite wide pale area on 3, followed by a black and a pale band; enlarged portion at the apex black; segment 4 entirely golden, white under certain light; 5 also golden except for a dark basal band.

Proboscis dark, except labella; usually with a pale golden subapical band or patch.

Wings extensively pale; prehumeral area usually pale on basal two-thirds; at times with a dark interruption, thus forming a prehumeral white spot. All other costal spots are wide, with the exception of the sector white area, which in rare instances is tiny. The accessory sector spot is particularly conspicuous in this species, and involves the costa completely. The black area between sector and accessory sector spots is represented by a mere dot on the costa. Black area between preapical costal and subcostal spots frequently divided into two, always so on vein 1, and very rarely continuous on costa; black spots on stem of 2 and 4.1 may be two or three. Pale fringe spots opposite all veins are so wide as to encroach upon, or entirely obliterate, the black areas, particularly opposite the first two veins. The greater part of fringe basal to opposite vein 6 is also pale.

Legs spotted, most of the tarsal segments with pale apical patches, some with basal pale patches also; tarsal segments often extensively pale.

Thorax with numerous broad pale scales on dorsum and sides, including sides and fossæ of mesonotum, decreasing in number and becoming absent in the middle in front of scutellum; pleura without scales. Anterior pronotal lobe with a tuft of scales.

Abdominal tergites with broad pale scales towards apices and sides from II to VII, the scales increasing in number and becoming mixed with black ones to form distinct lateral scale tufts on posterior segments, particularly on V to VII; VIII with numerous golden scales above, and both pale and dark scales beneath; ventrally, some pale scales toward lateroapical edges from II to VII; male like female, although with fewer scales on mesonotum and abdomen.

Male terminalia with parabasal spines of the *Myzomyia* type, somewhat similar to *kochi* in having spine 4 quite far from the basal group 1–3. The distance is not so great as in *kochi*. Dorsal lobe of harpago with a club, ventral lobe with apical spine longer than club; one slender internal spine, no external spine. Phallosome with six or seven leaflets, the largest well serrated on one side.

12. ANOPHELES LEUCOSPHYRUS Dönitz, 1901. Plate 12.

Medium-sized, highly spotted, with conspicuous band on tibiotarsal joint of hind leg.

Palpi of female dark with bands at 2–3, 3–4, and 4–5, the apical half of 5 pale. Some pale scales may be present at about middle of 2. Segment 2 of male palpi dark, with a variable amount of pale area in the middle; pale at 2–3; segment 3 dark, with a variable wide pale area in the middle, having a subapical golden, and an apical black, band; 4 entirely golden; 5 golden with a black basal band.

Proboscis dark, except labella.

Wings highly spotted, the extent and number of dark areas variable; vein 6 as well as others with many dark spots resembling only *tessellatus*. Fringe spots present usually up to 5.2; extra ones between apices of 5.1 and 5.2, and 5.2 and 6; none opposite 6 and sometimes also none opposite 5.2. (For other details see discussion below.)

Legs spotted. (See discussion below.)

Abdomen with black ventral scale tuft on VIII.

Male terminalia. (See discussion below and Plate 12.)

Discussion.—In the Philippines there are several types of this mosquito. We can recognize at least two distinct species, one of which seems to split into two forms. We shall designate the type found in Luzon and Mindanao as true *leucosphyrus;* that from Iwahig and Balabac, Palawan, as the Balabac variety; and that from rock holes (Mindanao) as near-*leucosphyrus*.

Near-*leucosphyrus* was first found by Mr. D. Santiago in 1930. The temporary name "near-*leucosphyrus*" was suggested by Dr. W. V. King, to whom the 1930 specimens were given. *Anopheles* near-*leucosphyrus* is undoubtedly a distinct species. Its larva differs from those of the other forms, while its adult shows some characters that readily separate it from the rest. The form found in Luzon and Mindanao runs closest to the *leucosphyrus* described in other countries by Christophers and others, while that found in Iwahig and Balabac, Palawan, varies somewhat from the Luzon type, both in larval and in adult forms. *Anopheles* near-*leucosphyrus* is smallest in average size, while collections from Iwahig show the largest individuals.

The posterior petiole index of near-*leucosphyrus* is remarkably different from all others, being considerably larger. The other indices for this form are also higher. By the anterior cell index the Balabac variety can be separated from the others. The males in all forms have higher indices than the females. In the position of the bases of the forked cells, the different forms also differ. Thus, in true *leucosphyrus* (Luzon and Mindanao) the base of the posterior forked cell is often nearer the wing base (sometimes in line with it, but never distinctly farther away) than that of the anterior forked cell. This seems to be true also in the illustration given by Christophers.(8, p. 178) *Anopheles* near-*leucosphyrus* has the base of the posterior cell distinctly farther away from the wing base than that of the anterior. The Balabac variety is often also like this, but may have the two bases in line with one another, the posterior not found nearer the wing base, however.

The wing markings are very much alike, varying in the dark areas in much the same way. In the case of the prehumeral pale spot, true *leucosphyrus* has it distinct, in the Balabac variety it is often tiny or lacking, and in near-*leucosphyrus* it is usually very tiny or lacking.

One of us (F. E. B.) is preparing a paper on this group, which will include the measurements for the various indices referred to above.

The conspicuous tibiotarsal band is about the same in all. The fore-tarsal bandings involve usually only the anterior surface of the legs of both *leucosphyrus* and near-*leucosphyrus;* the patches on the former, however, are larger and more distinct. In the Balabac variety the bands are often complete.

The Balabac variety is peculiar in having a white patch or complete band at the base of the fourth hind-tarsal segment. This may, in very rare cases, be absent in one of the legs of an individual, but it is not found absent in both. The hind-tarsal bands of this variety are also more conspicuous.

In the male genital characters, near-*leucosphyrus* is easily differentiated in having the smallest and least-serrated phallosomal leaflets. True *leucosphyrus* has usually fewer leaflets than the Balabac variety. The harpago normally has the same number of hairs as in the others.

13. ANOPHELES TESSELLATUS Theobald, 1901. Plate 13.

A medium-sized, highly spotted mosquito.

Palpi of female with a patch of pale scales at about middle of 2 and at about the middle of outer surface of dark basal band in 3; pale ring at 2–3, almost apical half of 3 white, base of 4 black, remaining three-fourths to apex white; base of 5 black, remaining portion golden or pale. Palpi of male with a patch of pale scales near base of 2, or a row of pale scales running the entire length of this segment in some individuals; pale bands at 2–3; 3 with a dark basal band, a large pale patch at middle, followed by a white band, and an apical dark ring; 4 and 5 white, except for basal bands and dark area on outer side.

Proboscis with apical half, together with labella, golden in female, not in male; a subapical dark patch on female proboscis.

Wings much like those of *leucosphyrus* with the addition of a pale fringe spot opposite apex of vein 6, and more extensive border scales. A long dark area is sometimes formed on 6 by the fusion of several small dark spots.

Legs spotted, the dark and white well contrasted; tiny pale patches at apices of femora and tibiæ; fore tarsi with pale apical rings on 1–4; basal rings 2–4 in female, in male usually absent; narrow apical ring on 1–4 of midtarsi; not so definite in male; narrow apical rings 1–4 on hind tarsi in both sexes.

Abdomen with tergites and sternites dark and devoid of scales.

Male terminalia: Dorsal lobe of harpago with a club; ventral lobe with apical spine longer than the club; one or two, slender, internal spines rarely present; no external spine. Phallosome with seven to ten leaflets on either side; in specimens from Luzon the leaflets tend to be less serrated than in those from Mindanao.

14. ANOPHELES FILIPINÆ Manalang, 1930. Plate 14.

A small dark mosquito, anopheline in attitude. Palpi of female dark; narrow pale ring at 2–3; a pale band of variable width at 3–4; apical white of 4 together with 5, which is completely white, forms apical band; the black band at middle of 4 varies in width. Palpi of male with apex of 3 white; 4 and 5 black at base and outer edges; rest white.

Proboscis dark, except labella.

Wings with costal pale spots, though smaller than usual, of the *Myzomyia* type; the humeral spot may be absent or indistinct; the forks of 2 may be entirely black or else interrupted at about the middle with pale areas; typically vein 6 has three dark areas and a pale fringe spot opposite its apex.

Legs dark; femora and tibiæ all dark, the apices indistinctly pale if at all. Fore tarsi with segment 1 usually having a fairly conspicuous band or patch; 2 less so; 3 still less or not at all; 4 and 5 entirely dark; midtarsi with segment 1 often banded, the rest dark; hind tarsi with segment 1 often banded; the rest entirely dark.

Abdomen dark, devoid of scales even on cerci; coxites with scales on the outer border.

Male terminalia: Dorsal lobe of harpago with a club; sometimes two clubs; ventral lobe with apical spine longer than club, sometimes branched; one or two external spines, longer than club but shorter than apical spine. Phallosome usually with five serrated leaflets on either side.

15. ANOPHELES MANGYANUS Banks, 1907. Plate 15.

Small, dark.

Palpi of female dark with pale bands at 2–3; apical white of 3 and basal white of 4 form wide subapical band; subapical dark band (variable in extent or entirely absent at times) formed at about middle of 4; apical white band of 4 together with segment 5, which is entirely white, form the apical band. Palpi of male with no pale band at 2–3; apex of 3 white; about basal half of 4, continuous to outer edge, black; base of 5 black; rest white.

Proboscis entirely dark, except labella.

Wings with humeral and presector costal spots well marked; veins 2.1 and 2.2 entirely dark, but 4.1 usually with a pale interruption at the middle; vein 6 usually with two dark areas,

the apical occupying about half of the vein; fringe spot opposite all veins except 6, which may rarely also have a spot.

Legs dark, without any definite white patch or ring on tarsal segments.

Abdomen dark, no scales on tergites, sternites, or cerci; but the coxites have scaling.

Male terminalia: Dorsal lobe of harpago with a club, sometimes incompletely fused; or one spine may be totally separated; ventral lobe with apical spine longer than club; external spine shorter than apical, but longer than club; one or two, slender, internal spines, about as long as external. Phallosome usually with five leaflets on either side, the largest ones serrated on one side.

16. ANOPHELES MINIMUS var. FLAVIROSTRIS Ludlow, 1914. Plate 16.

Small and dark, with anopheline attitude at rest.

Palpi of female and male resemble those in *A. mangyanus*.

Proboscis dark, with distinct flavescent area on ventral and lateral sides of apical half in female, often absent in male.

Wings very similar to wings of *mangyanus* except for absence or minuteness of humeral pale spot, and often also presector pale spot; vein 6 may be entirely dark except extreme base, and a pale fringe spot sometimes present opposite its apex.

Legs resemble those of *A. mangyanus*, although sometimes lighter in hue, and may have traces of paleness at apices of some tarsal segments.

Abdomen including cerci devoid of scales; coxites with scales.

Male terminalia: Dorsal lobe of harpago with a club; apical spine of ventral lobe longer than club; external spine a little shorter than apical, longer than club; internal spine one (rarely two), slender, always present. Phallosome with about five leaflets on either side, the largest ones serrated.

17. ANOPHELES LITORALIS King, 1932. Plate 17.

Medium-sized, brownish, with anopheline attitude at rest.

Palpi of female banded at 2–3 and 3–4; basal half of 4 dark, the apical white forming a continuous wide white apical band with 5, which is entirely pale. Palpi of male with a pale ring at 2–3; basal third of 3 black, followed by a mainly white area upwards to black subapical band, the apex white-ringed; segment 4 dark at base and along outer edge, white at middle towards apex and inner side; 5 with a black band at base and towards outer side where black area of the preceding segment somewhat

expands and merges with it, the black sometimes continuing towards the apex.

Proboscis dark, except labella.

Thorax with fossa of mesonotum having from two to four flat scales in male, and six to over ten in female.

Wings with costal sector spot often absent or indistinct in females; prominent in males; usually with white scales on prehumeral dark area, sometimes forming a complete prehumeral pale spot; in some specimens from Mindanao the basal part of the prehumeral costal area is entirely pale-scaled; no dark scales at origin of forks of 2 and frequently only two dark areas on vein 1 under midcostal black (Plate 17).

Legs spotted, mostly pale-scaled beneath, particularly mid- and hind femora and tibiæ as well as the fore-tarsal segments; apical and basal bands on most of the tarsal segments.

Abdomen with broad scales ventrally on VII, and few narrower ones on VIII; cerci with numerous broad scales.

Male terminalia: Dorsal lobe of harpago with a club; in one specimen there is a subsidiary smaller club; ventral lobe with apical spine, very much longer than club, somewhat flattened; one or two short, sometimes flattened, external spines; one or two internal spines longer than external, sometimes none. Phallosome with eight to fourteen serrated leaflets on either side, not markedly contrasted in length except the basal short ones.

18. ANOPHELES LUDLOWI Theobald, 1903. Plate 18.

Similar to *litoralis.*

Palpi very similar to those of *litoralis,* except that some females have black scales at the base of segment 5 forming an extra band; and in many males the basal dark area on 4 and 5 does not form a complete band.

Proboscis dark, except labella.

Thorax with fossa of mesonotum devoid of broad scales in male, usually also in female; rarely there are two or more scales in the female, which are, however, not as broad as those in *litoralis.*

Wings much as in *litoralis;* but the costal sector spot is complete and distinct, and there are no white scales on prehumeral dark area, but dark scales may be present at apex of stem of vein 2 immediately below the origin of 2.1–2.2.

Legs spotted, the spots more numerous and better defined and contrasted than those of *litoralis;* femora and tibiæ and tarsal segments largely dark-scaled; fore-tarsal segments 2 and 3 apically and basally banded, 1 with apical and 4 with basal band

only; 5 entirely dark; mid- and hind tarsi frequently without any basal bands.

Abdomen with some scales ventrally on VII and VIII; cerci with many broad scales.

Male terminalia: Dorsal lobe of harpago with a club; ventral lobe with apical spine much longer than club; external spine short; internal spine lacking. Phallosome with about five serrated leaflets on either side; the largest one somewhat S-shaped. In one specimen the largest on one side is not serrated.

19. ANOPHELES PARANGENSIS Ludlow, 1914. Plate 19.

A rare species; originally reported from Parang, Cotabato (1914); later found in Oriental Misamis (King, 1931); and in Davao Penal Colony (Nono, 1935), all in Mindanao Island.

The description and illustrations given here are from specmens kindly furnished by Mr. Andres Nono, formerly of Malaria Investigations, and now field director of the malaria control work of the Bureau of Prisons at Iwahig and Davao Penal Colonies.

Externally much like *ludlowi*, from which it differs in certain details of wing markings and leg spots.

Palpi of the female similar to those of *ludlowi*, the subapical dark band varying in width from a little less than half to about three-fourths of the apical white band. Palpi of the male also similar to those of *ludlowi*, but the preapical white on segment 3 (below the club) is much narrower.

Proboscis dark, except the labella.

Wings differ from those of *ludlowi* in having three dark spots on vein 6; two dark spots on vein 1 under the midcostal dark area; smaller subapical dark costal spot; extra pale fringe spot between the apices of the forks of vein 5, which may sometimes be fused with the pale fringe spot opposite 5.2; more extensive pale areas on fringe. Moreover, the accessory sector spot on subcosta and vein 1 is prominent and sometimes encroaches on the costa so that the midcostal dark area is broken in two; the outer accessory dark spot is sometimes so tiny as to be almost wanting; no dark scales at the forking of vein 2.

Legs more highly spotted than either those of *ludlowi* or of *litoralis*, the pale scales forming definite intermediate bands on some of the segments; wide apical and basal bands on fore tarsi.

Male terminalia: Phallosome with short, modified leaflets, and a membranous process at apex. Parabasal spines and harpagos modified, as shown in the illustrations.

20. ANOPHELES SUBPICTUS var. INDEFINITUS Ludlow, 1904. Plate 20.

Resembles *ludlowi* except that the legs are not speckled.

Palpi as in *ludlowi,* but the extra dark band on segment 5 has not been observed.

Proboscis dark, except labella.

Wings with humeral spot always present; presector costal spot sometimes absent; dark presector spot on vein 1 usually over half the length of the costal dark spot above; costal subapical dark spot as long or longer than pale area on either side; scattered white scales may be present on prehumeral area of costa; fringe spot between 5.2 and 6 sometimes present.

Legs dark, not speckled; fore tarsi 3 and 4 basally and apically banded in male and female, though less distinct in male; 1 apically and 5 basally banded; midtarsi with 1 to 3 narrowly banded apically, usually with basal patch on 2 to 4; hind tarsi with 1 to 4 apically but not basally banded; 5 entirely dark.

Abdomen as in *ludlowi.*

Male terminalia: Dorsal lobe of harpago with a club; a spine external to club, about as long as club itself in one specimen; ventral lobe with apical spine over twice the length of club; sometimes with two apical hairs; one or two external spines, sometimes flattened; variable in length; one to five internal spines or none. Phallosome with six to thirteen leaflets on either side, most of them serrated.

21. ANOPHELES VAGUS var. LIMOSUS King, 1932. Plate 21.

Resembles *subpictus* var. *indefinitus.*

Palpi of female similar in markings to those of *subpictus,* except that usually the preapical dark ring is half or less the length of apical white ring. Palpi of male similar to those of *subpictus,* except that usually the pale area before the enlargement of segment 3 is much narrower.

Proboscis as in *subpictus* var. *indefinitus.*

Wings much as in *subpictus,* from which they differ only in having the preapical dark costal area usually much shorter than the pale area on either side; presector dark spot on vein 1 half or less the costal spot above; prehumeral dark area seldom with white scales.

Legs dark; fore tarsi as of *indefinitus,* but male sometimes without basal band on 4 and without apical band on 3; mid- and hind tarsi much like those of *subpictus.*

Male terminalia: Dorsal lobe of harpago with a club; ventral lobe with apical spine about twice the length of club; one or

two, short, external spines; no internal spines (Plate 21). Phallosome leaflets comparatively long, serrated; usually five on either side.

22. ANOPHELES ANNULARIS van der Wulp, 1884. Plate 22.

Anopheles fuliginosus Giles, 1900.

Medium-sized, darkish, with very conspicuous white on hind legs; anopheline in attitude.

Palpi of female with terminal segment completely white or sometimes with a patch of black scales at about middle; narrow bands at 2–3 and 3–4. Palpi of male with some white scales on dorsal aspect of 2, a few scattered ones on 3; 4 and 5 black at base and toward outer sides, remaining area (middle to apex and inner sides) white.

Wings of pure white and black areas; humeral spot sometimes very tiny; subcostal spot in female often involving anterior portion of vein 1; in male involving vein 1 entirely; black and white areas vary in extent in different specimens; vein 5 with a black area at point of bifurcation; fringe spots opposite veins 2.1 to 6, except 2.2; white areas in the male more extensive.

Legs with midfemora and sometimes also hind femora with conspicuous pale spot on anterior surface toward apex; fore tarsi 1, 2, and 3 with wide apical bands; midtarsi 1 and 2 widely banded apically; 3 sometimes completely banded at apex, sometimes with only a patch or else entirely dark; hind-tarsal segment 1 apically banded; 2 with apical one-eighth to more than one-third white; 3, 4, and 5 entirely white.

Abdomen dark; on VI to VIII or VII and VIII, with some scales dorsally toward apices and sides, in some cases forming lateral tufts; VIII sometimes with white scales ventrally toward the sides in female; male with numerous white scales on VIII and IX on the upper (really the ventral) side.

Male terminalia: Dorsal lobe of harpago with a club sometimes duplicated, or incompletely fused; ventral lobe with apical spine longer than club; external spine one, about as long as club; usually two internal spines, about as long as club. Phallosome with broad fairly well serrated leaflets, the largest ones with tiny projections even on their broad surfaces; five or six leaflets on either side.

23. ANOPHELES KARWARI James, 1903. Plate 23.

Medium-sized, with conspicuous hind-tarsal bandings.

Palpi of female with segment 2 black, with narrow pale apical ring; 3 dark, with conspicuous white apical band; 4

white, with black basal band; 5 with apical two-thirds, or so, white; base black. Palpi of male as shown in Plate 23.

Proboscis dark, except labella.

Wings as figured in Plate 23. The dark areas somewhat variable; frequently there are two instead of three dark spots on vein 1 under the main costal dark area; 2.1 often has only the apical dark area, while 2.2 occasionally has only the basal dark area.

Legs with fore-tarsal segments 1 to 3 conspicuously, and 4 narrowly, banded apically. Midtarsi with narrow apical bands on 1 to 3; hind tarsi with 1 narrowly, 2 and 3 widely, banded at apices; 4 with wide apical and basal bands; 5 entirely white.

Abdomen dark, with golden scales on dorsum of VIII.

Male terminalia: Dorsal lobe of harpago with a club; apical spine of ventral lobe about half again as long as club; external spine very short and stout; internal spine shorter than club. Phallosome leaflets much like those of *maculatus* but not as broad; serrated; six leaflets on one side and seven on the other in specimens dissected. We have only a few males of this species.

24. ANOPHELES MACULATUS Theobald, 1901. Plate 24.

Medium-sized to moderately large. Hind legs conspicuous for their wide white bands. Those from the Baguio highlands generally larger and darker than those from the lowlands.

None of the females in our collection shows speckling on the palpi; but some of those from Baguio have a line of pale scales running lengthwise to a considerable distance in middle of segment 3. A pale ring located at 2–3; apex of 3 and base of 4 both white, forming the subapical white band; middle of 4 black, which constitutes the subapical black band; its apex, together with the entirely white segment 5, forms the apical white band; sometimes there are a few dark scales near the tip of segment 5. Palpi of male with variable pale area at middle of segment 2; pale ring at 2–3; 3 mostly dark with a line of pale scales at middle, a subapical white band and an indefinite apical black ring contiguous with basal black area of 4; a black band at 4–5 continuous with the black area along outer sides of both 4 and 5, the remaining area of both segments white.

Proboscis dark, except labella.

Wings variable in markings. In specimens from Baguio (even the males) the dark areas are larger and more prominent than in those from the lowlands. The accessory sector spot does not

encroach even partly upon the costa, while the costal sector spot may be incomplete or small. The subapical dark spot is always very much longer than the apical dark spot, thus making the pale areas on either side quite inconspicuous. Not less than three dark areas on vein 6 have been found in the Baguio specimens. In the lowland forms, particularly those from northern Mindanao, the dark areas are much reduced so that the yellow parts are more conspicuous. The subapical dark area is only about as long as, or shorter than, the apical dark area, while the accessory sector spot extends to the costa. Some of the dark areas in this form may be absent, as that at the apex of 3 or at the base of 2.1. In one case, however, the basal dark spots of 4.1 and 4.2 are contiguous with that on the apex of the petiole. Not infrequently there are two dark spots on vein 6.

Legs dark, with well-contrasted pale spots. Fore tarsi 1 with pale apical patch or band; apical and basal patches or bands on 2 and 3; 4 with basal patch and 5 all dark. Usually only 1 and 2 of the midleg have apical patches which are less distinct than those of the foreleg. Hind-tarsal segment 1 with narrow apical patch or ring, 2 with wide apical white band; 3 and 4 both broadly banded at bases and apices, 5 entirely white.

Abdomen: In our collections from both highlands and lowlands of Luzon and Mindanao only the typical form seems to be represented. Generally specimens from Luzon, including the highlands (Baguio), tend to have very scanty scalings, on the abdominal tergites. Those from Mindanao show more scales, usually a few narrow ones on II, increasing in number and becoming broader on the posterior segments. In some a few black scales are mixed with the other scales along the posterolateral sides of segments VI to VIII, forming, in a few cases, lateral scale tufts.

Male terminalia: Dorsal lobe of harpago, with a club, not completely fused at times; ventral lobe with apical spine longer than club; external spine seldom present; internal spine usually present, rarely absent, sometimes in duplicate. Phallosome with broad serrated leaflets numbering five to seven on either side; the largest ones have spinous projections even on the broad surface. Specimens from highlands and lowlands and from different islands are very much alike (Plate 24) in the characters of the male terminalia.

25. ANOPHELES PHILIPPINENSIS Ludlow, 1902. Plate 25.

Medium-sized, with conspicuous white on hind legs.

Palpi of female dark; narrow pale bands at 2–3 and 3–4; apical segment entirely white and apex of 4 white, together forming the apical band. Palpi of male dark; a pale ring at 2–3; a pale subapical internal patch on 3, the apex dark; bases and outer sides of 4 and 5 dark, the rest white.

Proboscis dark, except labella.

Wings, as figured, can be differentiated from those of *annularis* (*fuliginosus*) by the yellow and dark scalings, and particularly by the absence of dark scales at the middle of the continuous pale area formed by 5.2 and its petiole; *annularis* (*fuliginosus*) has black and white scales and an extensive dark area at the middle of the vein mentioned.

Abdomen with dorsum dark and with dark and pale scales usually at the lateral sides of the posterior ends of segments V to VIII, forming lateral tufts. Ventrally there may be a few scales along the sides of these segments, but the scales are prominent toward the midposterior end of VII and a number in middle of VIII. In the male the lateral scale tufts are insignificant or wanting. Cerci of female and terminal segment of male covered with scales.

Legs dark with pale patches on apices of femora and tibiæ; a pale longitudinal line running almost the entire lengths of midfemora and hind femora and tibiæ underneath. Fore tarsi 1 to 3 widely banded apically; midtarsi with narrow ring or patch at apices of 1 to 3; a tiny pale patch on apex of first hind tarsus; a variable wide area at apex of 2; 3 to 5 entirely white.

Male terminalia: Harpago very variable; no two individuals of those dissected are alike; and no two harpagos in an individual, except in one, are exactly the same. Dorsal lobe has a club and may have a subsidiary club; ventral lobe with apical spine longer than club; one or two external spines, about as long as club or longer, but may be very short; sometimes much flattened and once seen to be clubbed; one to four internal spines slender, about as long as club, or longer. Phallosome with five to nine serrated leaflets on either side in addition to the fine spines that are sometimes present.

26. Balabac ANOPHELES species or variety (?). Plate 26.

See discussion under *leucosphyrus*. Male and female much like *leucosphyrus;* anopheline in attitude when at rest.

Palpi like those of *leucosphyrus* in both sexes.

Proboscis as in *leucosphyrus*.

Wings similar to those of *leucosphyrus*, except that the prehumeral pale spot is usually tiny or absent and a costal accessory sector pale spot is sometimes present.

Legs as in *leucosphyrus*, but the fore-tarsal bandings are complete and distinct; and the fourth hind-tarsal segment has a pale band or patch at base.

Abdomen similar to that of *leucosphyrus*.

Male terminalia: Dorsal lobe of harpago with a club; apical spine of ventral lobe a little shorter than club; no external spine; one internal spine, over half the length of club. Phallosome usually with eight serrated leaflets on either side.

27. ANOPHELES near-LEUCOSPHYRUS (?). Plate 27.

See discussion under *leucosphyrus*. Rather small delicate mosquitoes; anopheline in attitude.

Palpi as in *leucosphyrus* in both sexes.

Proboscis as in *leucosphyrus*.

Wings much as in *leucosphyrus;* prehumeral pale spot usually absent; accessory sector pale spot on costa sometimes present.

Legs as in *leucosphyrus*.

Abdomen as in *leucosphyrus*.

Male terminalia: Harpago similar to that of *leucosphyrus;* in one a duplication of both apical and external spines was found. Phallosome with about seven short serrated leaflets on either side.

28. ANOPHELES of AITKENI group (?).

From Mount Banahao, Luzon. Included in our key to the larvæ of Philippine anopheles. No adult known.

KEY TO THE PHILIPPINE SPECIES OF ANOPHELES

The Anophelini are a tribe of the subfamily Culicinæ, family Culicidæ, order Diptera. As a rule the Anophelini are separated from other Culicidæ by several criteria, some of which are the following:

The wings of the commoner anophelines are usually distinctly spotted. However, this criterion is not always clear, for some anophelines have wings that are not spotted. In others the spots are so small as to be almost invisible without a lens. Also spotting is seen in a few species of mosquitoes that are not in the tribe Anophelini.

The palpi of both sexes of Anophelini are long, being about equal to the proboscis. The male palpi have a clubbed end, the last two apical segments being enlarged and somewhat flattened.

The resting attitude of an anopheline is apt to be characteristically different from that of other mosquitoes. As a rule the body of the anopheline is held at an angle with the surface on which the insect is resting. This angle may be as great as 90° but usually is from 30° to 45°. In *Culex* mosquitoes the body is usually held horizontally, parallel to the resting surface, the thorax sometimes giving the insect a "hump-backed" appearance. This criterion is not always dependable as some anophelines assume usually, or at times, a *Culex*-like attitude; but in many anophelines the body is held quite straight, at an angle with the resting surface.

The abdomen of Anophelini is either entirely devoid of scales or else has a variable development of loosely applied scales. Even in the most scaly species the sternites, at least, are largely bare. The tribes Megarhinini and Culicini have both tergites and sternites clothed with scales. The scutellum of Anophelini is evenly rounded.

The males of Anophelini have a large single claw on each foreleg.

The following key applies to Philippine Anophelini.

Key to adult Philippine Anopheles mosquitoes.

1. Hind legs with one or more segments widely banded[2] or completely white ..... 2.
   Hind legs with one or more segments narrowly banded or all segments entirely dark ..... 11.
2. At least the last tarsal segment of the hind leg completely white..... 3.
   The last tarsal segment of the hind leg entirely black or incompletely white ..... 6.
3. Third and fourth tarsal segments of hind leg also completely white.. 4.
   Third and fourth tarsal segments of hind leg not completely white.... 5.
4. A dark area at the bifurcation point of longitudinal wing vein 5. *fuliginosus.*
   No dark area at the bifurcation point of longitudinal wing vein 5. *philippinensis.*
5. Legs spotted; wing vein 6 usually with three dark spots.... *maculatus.*
   Legs not spotted; wing vein 6 with two dark spots..... *karwari.*
6. Legs spotted ..... 7.
   Legs not spotted ..... 10.

[2] A wide band is one that will easily cover at least one-fourth of the third hind-tarsal segment. It can easily be seen with the unaided eye. A narrow band will cover at most about a tenth, usually less, of the third hind-tarsal segment. It can be seen with the naked eye, if at all, as a mere shiny speck.

7. Tibiotarsal articulation of hind leg not covered with wide band; abdomen with ventral scale tufts on segments II to VII; mesonotum with two distinct eyelike spots ..... *kochi.*
   Tibiotarsal articulation of hind leg covered with continuous broad white "knee" band; abdominal segments without ventral scale tufts except sometimes on VI and VII; mesonotum without eyelike spots..8.
8. Fourth hind tarsal segment with a band or patch of pale scales at base; fore-tarsal bands distinct and complete.
   Balabac species or variety (?).
   Fourth hind tarsal segment entirely dark at base; fore-tarsal bands often incomplete or indistinct ..... 9.
9. Posterior petiole index about 1.5, usually more;[3] anterior forked cell base not in line with that of posterior forked cell but nearer the wing base; prehumeral wing spot small or absent.
   near-*leucosphyrus.*
   Posterior petiole index about 1.0, usually less; anterior forked cell base in line with that of posterior forked cell or else farther from wing base; prehumeral wing spot large ..... *leucosphyrus.*
10. Femur of hind leg widely banded near the middle; wing veins 5 and 6 extensively dark; subcostal wing spot absent.
    lindesayi var. *benguetensis.*
    Femur of hind leg not banded near the middle; wing veins 5 and 6 extensively pale; subcostal wing spot present.
    hyrcanus var. *nigerrimus.*
11. Legs conspicuously spotted ..... 12.
    Legs not spotted or with scattered white scales only ..... 16.
12. One or more dark patches at or near bifurcation point of wing vein 5; posterior branch of vein 2 (2.2) usually with three or more dark patches ..... 13.
    No dark patch at or near bifurcation point of wing vein 5; posterior branch of vein 2 (2.2) with not more than two dark patches ..... 14.
13. Dark patches at middle of wing vein 3; abdominal tergites devoid of scales ..... *tessellatus.*
    No dark patches at middle of wing vein 3; abdominal tergites with numerous scales ..... *kolambuganensis.*
14. Three dark patches on wing vein 6; pale fringe spot between apices of forks of vein 5 (5.1 and 5.2) ..... *parangensis.*
    Two dark patches on wing vein 6; no pale fringe spot between apices of forks of vein 5 (5.1 and 5.2) ..... 15.
15. Broad flat scales on fossa of mesonotum, in male two to four, in female six to more than ten; femora and tibiæ of midlegs and hind legs, and fore tarsi largely pale-scaled beneath ..... *litoralis.*
    Broad flat scales on fossa of mesonotum wanting in male, sometimes one or two present in female; femora and tibiæ of midlegs and hind legs and fore tarsi largely dark-scaled beneath ..... *ludlowi.*
16. Wings entirely dark ..... 17.
    Wings with a pale area ..... 18.

[3] The posterior petiole index is obtained by dividing the length of the petiole of the posterior forked cell of the wing by the length of vein 4.2.

17. Phallosome without leaflets or spinous projections. *aitkeni* var. *bengalensis.*
Phallosome without leaflets, but with spinous projections. *insulæflorum.*
18. Costal wing margin without sector and presector spots..... 19.
Costal wing margin with either sector or presector spot, or both.... 22.
19. Basal third of costa, including that part under it of the subcosta and vein 1, with pale interruptions or scattered pale scales; two or more of fore and hind tarsal segments with distinct apical band or patch ..... 20.
Basal third of costa including that part under it of the subcosta and vein 1 without pale interruptions or scattered pale scales; fore and hind tarsal segments entirely dark or with indistinct pale patches. *baezai* (?).
20. Femora and tibiæ with distinct scattered white scales; ventral white scale tufts very conspicuous..... *pseudobarbirostris.*
Femora and tibiæ without scattered white scales; ventral white scale tufts absent or very inconspicuous..... 21.
21. Apex of wing with a wide pale fringe spot extending to at least the apices of vein 3 and posterior branch of vein 2 (2.2); subapical pale costal spot does not involve extreme tips of vein 1 and 2.1; palpi of male with extensive white scaling on club; palpi of female banded. *hyrcanus* var. *sinensis.*
Apex of wing with narrow pale fringe spots; subapical pale costal spot involves extreme tips of veins 1 and 2.1; palpi of male extensively dark on club; palpi of female not banded..... *barbirostris.*
22. Wing fringe spots opposite the apices of from vein 2.2 to vein 6 absent; usually one spot between 5.2 and 6; a very large mosquito, largest Philippine *Anopheles*..... *gigas* var. *formosus.*
Fringe spots present on all or most of the apices of veins 1 to 6; small or medium-sized mosquitoes..... 23.
23. No dark area at bifurcation point of vein 5; two or more segments of fore tarsi apically and basally banded; brownish mosquitoes..... 24.
A dark area at bifurcation point of vein 5; fore tarsi entirely dark or with only a few pale scales or a minute ring apically; blackish mosquitoes ..... 25.
24. Subapical black area of wing as long as the pale area on either side or longer; presector dark area on vein 1 over half the length of the costal spot above..... *subpictus* var. *indefinitus.*
Subapical black area of wing much shorter than the pale area on either side; presector dark area on vein 1 less than half the length of the costal spot above or entirely absent..... *vagus* var. *limosus.*
25. One or two of fore-tarsal segments with a ring or pale patch apically. *filipinæ.*
Fore-tarsal segments entirely dark..... 26.
26. Costal humeral spot of wing present and complete; apical half of female entirely dark ..... *mangyanus.*
Costal humeral spot of wing absent or incomplete; proboscis of female proboscis with pale scalings ventrally and laterally. *minimus* var. *flavirostris.*

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ILLUSTRATIONS

1, Palp.
2, Proboscis.
3, Mesonotum.
4, Wing.
5, Leg.
  a, Foreleg.
  b, Middle leg.
  c, Hind leg.
6, Abdomen.
  a, Dorsal.
  b, Ventral.

7, Terminalia.
  A, Harpago.
    x, Dorsal lobe.
      a, External part.
      b, Internal part.
    y, Ventral lobe.
      a, External spine.
      b, Internal spine.
  B, Phallosome.
    a, Stem.
    b, Leaflets.
  C, Process of segment IX.
  D, Coxite.
    a, Expanded organ on side of coxite.
  E, Style.

[Only the parts necessary for the identification of the species are shown in any plate. Unless otherwise noted below, when there are two or more drawings of the same part—for example, the harpago—they represent common variations. If these variations have geographic or unusual significance the fact is mentioned. Frequently both the male and the female palps are shown; the former has a more prominent club at the outer tip than the latter. When the palps of both sexes are shown, those of the male are the upper. Frequently only a part of a leg is drawn; sometimes only the tarsal segments are required for identification.]

Plate 1. Anopheles aitkeni var. bengalensis Puri

Figs. 1 and 2. Palps and proboscis, upper, female; lower, male.
Fig. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Center, hind femur and tibia; at right, tarsal segments of hind leg.
7A. Harpago, *a*, external part, *b*, internal part of dorsal lobe.
7B. Phallosome.

Plate 2. Anopheles gigas var. formosus Ludlow

Figs. 1 and 2. Palps and proboscis, upper, male; lower, female.
Fig. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Center, hind femur and tibia; at right, tarsal segments of hind leg.
7A. Various types of harpagos.
7B. Above, leaflets on one side; below, tip and leaflets of phallosome, showing variations in serrations of leaflets.

Plate 3. Anopheles insulæflorum Swellengrebel and Swellengrebel de Graaf

Fig. 1. Palps, above, male; below, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Two types of harpagos.
7B. Two types of phallosomes.

PLATE 4. ANOPHELES LINDESAYI VAR. BENGUETENSIS KING

FIG. 1. Upper, male palp; below, female palp.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. In middle, hind femur; at right, tarsal segments of hind leg.
7A. Types of harpagos.
7B. Tip and leaflets on one side of phallosome.

PLATE 5. ANOPHELES BAEZAI GATER (VAR. ?)

FIGS. 1 and 2. Palps and proboscis, upper, male; lower, female.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. (Right) first, and (middle) second, third, fourth, and fifth hind tarsal segments.
7A. Harpago from one individual showing how one side differs from the other.
7B. Above, tip and leaflets of phallosome without serrations; below, tip and leaflets of phallosome with serrations.
7C. Process of abdominal segment IX.

PLATE 6. ANOPHELES BARBIROSTRIS VAN DER WULP

FIGS. 1 and 2. Palps and proboscis, upper, male; lower, female.
FIG. 4. Upper, whole wing of common form; lower, tip of wing showing variation of fringe spots, rarer form.
5*a*. Fore-tarsal segments, Philippine specimen.
5*c*. Middle, hind-tarsal segments, Indian specimen, showing more-marked white rings. Right, hind-tarsal segments, Philippine specimen.
6*a*. Upper, ventral side of abdomen, Philippine form, having very few white scales. Lower, ventral side of abdomen, Indian form, having many white scales.
7A. Harpago, one side.
7B. *b*, Leaflets on one side of phallosome.
7C. Process of abdominal segment IX.

PLATE 7. ANOPHELES HYRCANUS VAR. NIGERRIMUS GILES

FIGS. 1 and 2. Palps and proboscis, upper, male; lower female.
FIG. 4. Wing, upper, common form; lower, less common, tip of wing showing much wider pale spot at apex.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Harpago, one side.
7B. Phallosomes, apical portion, showing variations in the size, shape, and serrations of leaflets; upper left and lower right, Luzon forms; upper right, Mindanao form.
7C. Process of abdominal segment IX.

PLATE 8. ANOPHELES HYRCANUS VAR. SINENSIS WIEDEMANN

FIG. 1. Palps, left, male; right, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Tips of phallosomes showing variations in leaflets; upper right, Luzon lowland form; upper left, Hongkong form; lower right and left, Baguio (highland) form.
7B. Parts of harpagos, showing variations in the spines and club-shaped process; upper right, Philippine form with club not fused; lower midlde, spines of harpago, Hongkong form; lower left, Baguio form.
7C. Process of abdominal segment IX.

PLATE 9. ANOPHELES PSEUDOBARBIROSTRIS LUDLOW

FIGS. 1 and 2. Palps and proboscis, upper, female; lower, male.
FIG. 4. Wing.
5*a*. Upper, fore-tarsal segments; lower, part of fore femur showing white scales, enlarged.
5*c*. Hind-tarsal segments.
6*b*. Ventral aspect of abdomen showing tuft of white scales.
7A. Two types of harpagos.
7B. Tips and leaflets of phallosome, at left, usual form; at right, abnormal duplication of the shorter leaflets.
7C. Process of abdominal segment IX.

PLATE 10. ANOPHELES KOCHI DÖNITZ

FIG. 1. Palps, upper, male; lower, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
6*b*. Ventral aspect of abdomen showing black scale tuft.
7A. Two types of harpagos.
7B. Tips and leaflets on one side of phallosome, showing variations in leaflets.

PLATE 11. ANOPHELES KOLAMBUGANENSIS BAISAS

FIG. 1. Palps, upper, male; lower, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
6*a*. Dorsal aspect of abdomen showing scales, hairs omitted.
7A. Harpago, one side.
7B. Tips of phallosome showing leaflets.

PLATE 12. ANOPHELES LEUCOSPHYRUS DÖNITZ

FIGS. 1 and 2. Palps and proboscis, upper, male; lower, female.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Upper right, hind femur; middle, hind tibia and first tarsal segment; lower right, second, third, fourth, and fifth tarsal segments of hind leg.
7A. Harpagos showing variations in the clublike process.
7B. Tip of leaflets of phallosome.

PLATE 13. ANOPHELES TESSELLATUS THEOBALD

FIGS. 1 and 2. Palps and proboscis, upper, female; lower, male.
FIG. 4. Upper, costa showing variation in costal markings; lower, whole wing, usual form.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Two types of harpagos.
7B. Tips and leaflets of phallosome showing variations in the size and serrations of leaflets; upper and middle, Luzon forms; lower, Mindanao form.

PLATE 14. ANOPHELES FILIPINÆ MANALANG

FIG. 1. Palps, upper, male; lower, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments, the upper being the first.
7A. Types of harpagos.
7B. Tip and leaflets of phallosome.

PLATE 15. ANOPHELES MANGYANUS BANKS

FIGS. 1 and 2. Palps and proboscis, upper, female; lower, male palps.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Two types of harpagos.
7B. Tips and leaflets of phallosome.

PLATE 16. ANOPHELES MINIMUS VAR. FLAVIROSTRIS LUDLOW

FIGS. 1 and 2. Palps and proboscis, upper, male; lower, female.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Two types of harpagos.
7B. Tips and leaflets of phallosomes.

PLATE 17. ANOPHELES LITORALIS KING

FIG. 1. Palps, upper, male; lower, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Different types of harpagos.
7B. Tips and leaflets of phallosome.

PLATE 18. ANOPHELES LUDLOWI THEOBALD

FIG. 1. Upper, male palp; middle (usual), lower (with extra dark ring, unusual) female palps.
FIG. 2. Female proboscis, lower.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Harpargo, one side.
7B. Tip and leaflets of phallosome; the right side representing an unusual form.

PLATE 19. ANOPHELES PARANGENSIS LUDLOW

FIG. 1. Palps, upper, female; lower, male.
2. Proboscis, upper, female; lower, male.
4. Upper, costa of wing showing tiny subapical dark costal spot; continuous midcostal dark area; very tiny outer accessory spot; and two dark spots under the midcostal dark area. Lower, whole wing. Note the broken midcostal dark area, and the pale fringe spot between the apices of forks of vein 5, which is fused with the pale fringe spot opposite vein 5.2.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Harpago of male terminalia.
7B. Phallosome of male terminalia.
7D. *a*, Expanded organ on side of coxite.

PLATE 20. ANOPHELES SUBPICTUS VAR. INDEFINITUS LUDLOW

FIG. 1. Palp, upper, male; lower, female.
2. Female proboscis.
4. Wing, upper, costa showing variation in markings.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Two types of harpagos.
7B. Tips and leaflets of phallosome.

PLATE 21. ANOPHELES VAGUS VAR. LIMOSUS KING

FIGS. 1 and 2. Palps and proboscis, upper, female; lower, male.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Harpagos.
7B. Tips and leaflets of phallosomes.

PLATE 22. ANOPHELES ANNULARIS VAN DER WULP

FIGS. 1 and 2. Palps and proboscis, upper, female; lower, male.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*b*. Femur of midleg.
5*c*. Hind-tarsal segments.
7A. Two types of harpagos.
7B. Tips and leaflets of phallosomes.

PLATE 23. ANOPHELES KARWARI JAMES

FIG. 1. Palps, upper, male; lower, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Harpago, from one individual.
7B. Tip and leaflets of phallosome.

PLATE 24. ANOPHELES MACULATUS THEOBALD

FIG. 1. Palps, upper, male; lower, female.
2. Female proboscis.
4. Wings; uppermost, costa of an unusually large specimen from Baguio; second, costa showing variation in markings; middle and lower, whole wings showing variations in markings.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
6*a*. Dorsal aspect of abdominal segment II showing (left) few, narrow scales in the Philippine form, and (right) numerous, broad scales in the Indian form, hairs omitted.
7A. Harpago, one side.
7B. Tips and leaflets of phallosomes.

PLATE 25. ANOPHELES PHILIPPINENSIS LUDLOW

FIG. 1. Palps, upper, male; lower, female.
FIG. 2. Female proboscis.
FIG. 4. Wing.
5*a*. Fore-tarsal segments.
5*b*. Midfemur.
5*c*. Hind-tarsal segments.
7A. Showing great variations in harpagos.
7B. Tips and leaflets of phallosomes.

PLATE 26. BALABAC ANOPHELES SPECIES OR VARIETY

FIG. 1. Palps, right, male; left, female.
2. Female proboscis.
4. Wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments, including tibiotarsal white-banded joint.
7A. Different types of harpagos.
7B. Tips and leaflets of phallosomes.

PLATE 27. ANOPHELES NEAR-LEUCOSPHYRUS KING

FIG. 1. Palps, upper, male; lower, female.
2. Female proboscis.
4. Upper, costa showing variation in markings; lower, whole wing.
5*a*. Fore-tarsal segments.
5*c*. Hind-tarsal segments.
7A. Different types of harpagos.
7B. Tips and leaflets of phallosomes.

PLATE 28. ANOPHELES MINIMUS VAR. FLAVIROSTRIS LUDLOW

PLATE 29. TYPICAL WINGS

FIG. 1. *Anopheles aitkeni* var. *bengalensis* Puri.
2. *Anopheles gigas* var. *formosus* Ludlow.
3. *Anopheles insulæflorum* Swellengrebel and Swellengrebel de Graaf.
4. *Anopheles lindesayi* var. *benguetensis* King.
5. *Anopheles baezai* Gater (variety ?).

PLATE 30. TYPICAL WINGS

FIG. 6. *Anopheles barbirostris* van der Wulp.
7. *Anopheles hyrcanus* var. *nigerrimus* Giles.
8. *Anopheles hyrcanus* var. *sinensis* Wiedemann.
9. *Anopheles pseudobarbirostris* Ludlow.
10. *Anopheles kochi* Dönitz.

PLATE 31. TYPICAL WINGS

FIG. 11. *Anopheles kolambuganensis* Baisas.
12. *Anopheles leucosphyrus* Dönitz.
13. *Anopheles tessellatus* Theobald.
14. *Anopheles filipinæ* Manalang.
15. *Anopheles mangyanus* Banks.

PLATE 32. TYPICAL WINGS

FIG. 16. *Anopheles minimus* var. *flavirostris* Ludlow.
17. *Anopheles litoralis* King.
18. *Anopheles ludlowi* Theobald.
20. *Anopheles subpictus* var. *indefinitus* Ludlow.
21. *Anopheles vagus* var. *limosus* King.

PLATE 33. TYPICAL WINGS

FIG. 22. *Anopheles annularis* van der Wulp.
23. *Anopheles karwari* James.
24. *Anopheles maculatus* Theobald.
25. *Anopheles philippinensis* Ludlow.
26. Balabac *Anopheles* species or variety.
27. *Anopheles* near-*leucosphyrus* King.

PLATE 34. TYPICAL ABDOMINAL SEGMENTS OF SOME PHILIPPINE ANOPHELES

FIG. 6. *Anopheles barbirostris* van der Wulp; ventral.
7. *Anopheles hyrcanus* var. *nigerrimus* Giles; ventral.

FIG. 9. *Anopheles pseudobarbirostris* Ludlow; ventral.
10. *Anopheles kochi* Dönitz; ventral.
11. *Anopheles kolambuganensis* Baisas; dorsal.

TEXT FIGURES

FIG. 1. *Anopheles maculatus* Theobald; head parts; *1*, palp; *2*, proboscis; *lb*, labella; *a*, antenna; *c*, clypeus; *lr*, tip of labium, epipharynx; *mb*, mandible; *mx*, maxilla; *v*, vertex; *vt*, vertical tuft; *e*, eye. (Camera-lucida drawing, semidiagrammatic.)

2. *Anopheles maculatus* Theobald; thorax; *pt*, prothorax; *ms*, mesothorax; *mt*, metathorax; *3*, mesonotum; *apl*, anterior pronotal lobe; *pph*, propleural hairs; *sc*, scutellum; *h*, halteres; *f*, fossa. (Camera-lucida drawing, semidiagrammatic.)

3. *Anopheles maculatus* Theobald; wing, upper figure shows venation; lower figure shows ornamentation. *a*, Apex; *b*, base; *c*, costa; *Sc*, subcosta; *f*, fringe; *1* to *6*, longitudinal veins; *2.1*, anterior branch of second longitudinal vein; *2.2*, posterior branch of second longitudinal vein; *cv*, crossveins; *hv*, humeral crossvein; *af*, anterior forked cell; *pf*, posterior forked cell; *ph*, prehumeral white spot; *hs*, humeral spot; *ps*, presector spot; *s*, sector spot; *as*, accessory sector spot; *pab*, preapical black spot; *scw*, subcostal white spot; *fs*, fringe spots. (Camera-lucida drawing, semidiagrammatic.)

4. *Anopheles maculatus* Theobald; foreleg; *c*, coxa; *tr*, trochanter; *f*, femur; *tb*, tibia; *ts*, tarsal segments; *ab*, apical band; *bb*, basal band. (Camera-lucida drawing, semidiagrammatic.)

5. *Anopheles pseudobarbirostris* Ludlow; abdomen, segments I to VIII; *vt*, ventral tufts. (Camera-lucida drawing, semidiagrammatic.)

6. Male terminalia; *Anopheles maculatus* Theobald, upper; harpago of *A. maculatus* Theo., lower left; harpago of *A. aitkeni* var. *bengalensis* Puri, lower right. *A*, harpago; *x*, dorsal lobe; *y*, ventral lobe; *a*, external; *b*, internal; *as*, external spine; *bs*, internal spine; *cs*, apical spine; *B*, phallosome; *a*, stem; *b*, leaflets; D, coxite; E, style. (Camera-lucida drawing, semidiagrammatic.)

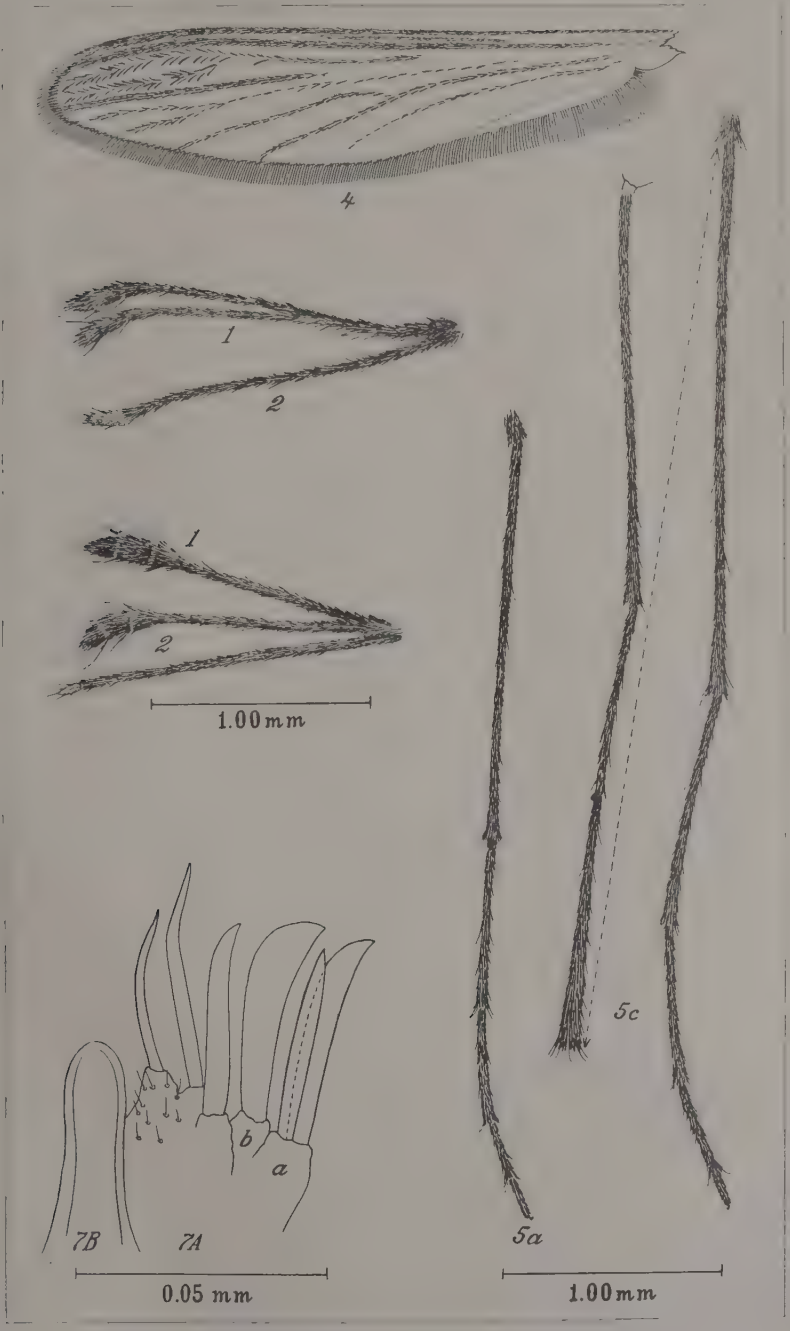

PLATE 1. ANOPHELES AITKENI VAR. BENGALENSIS.

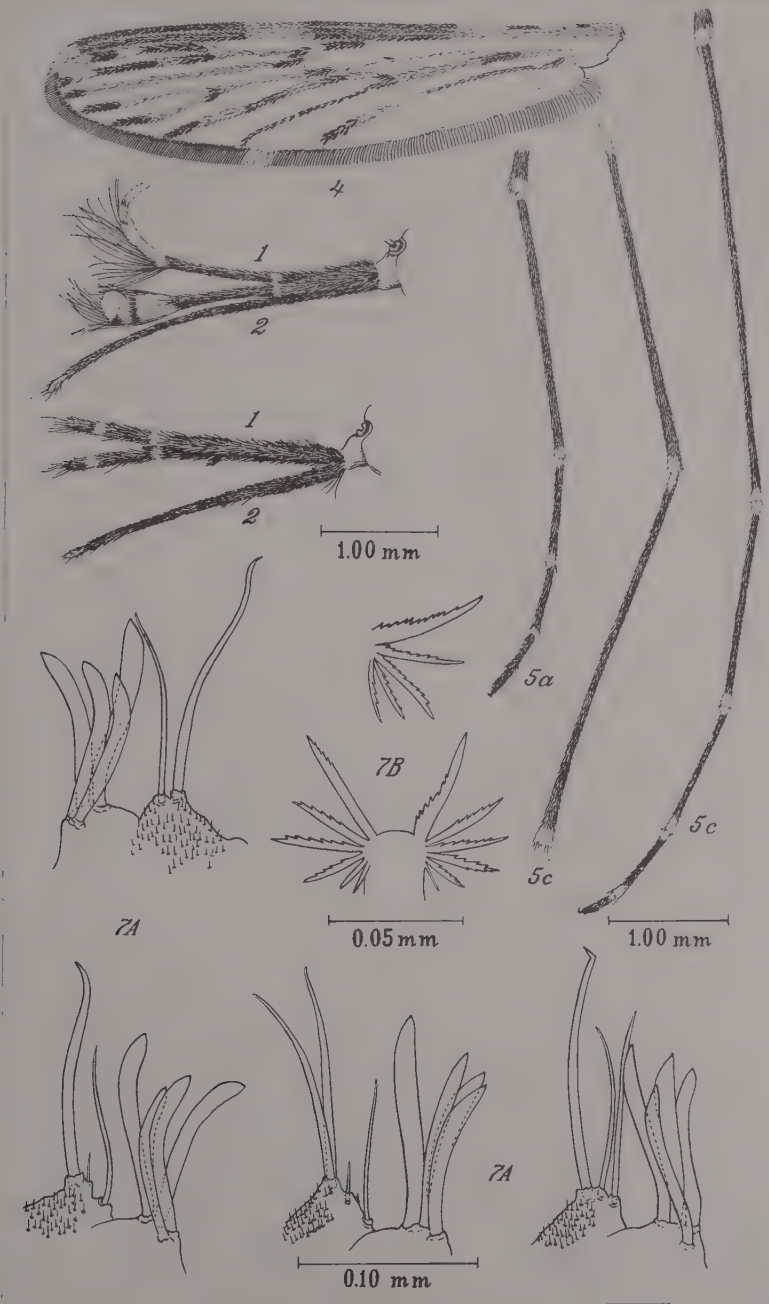

PLATE 2. ANOPHELES GIGAS VAR. FORMOSUS.

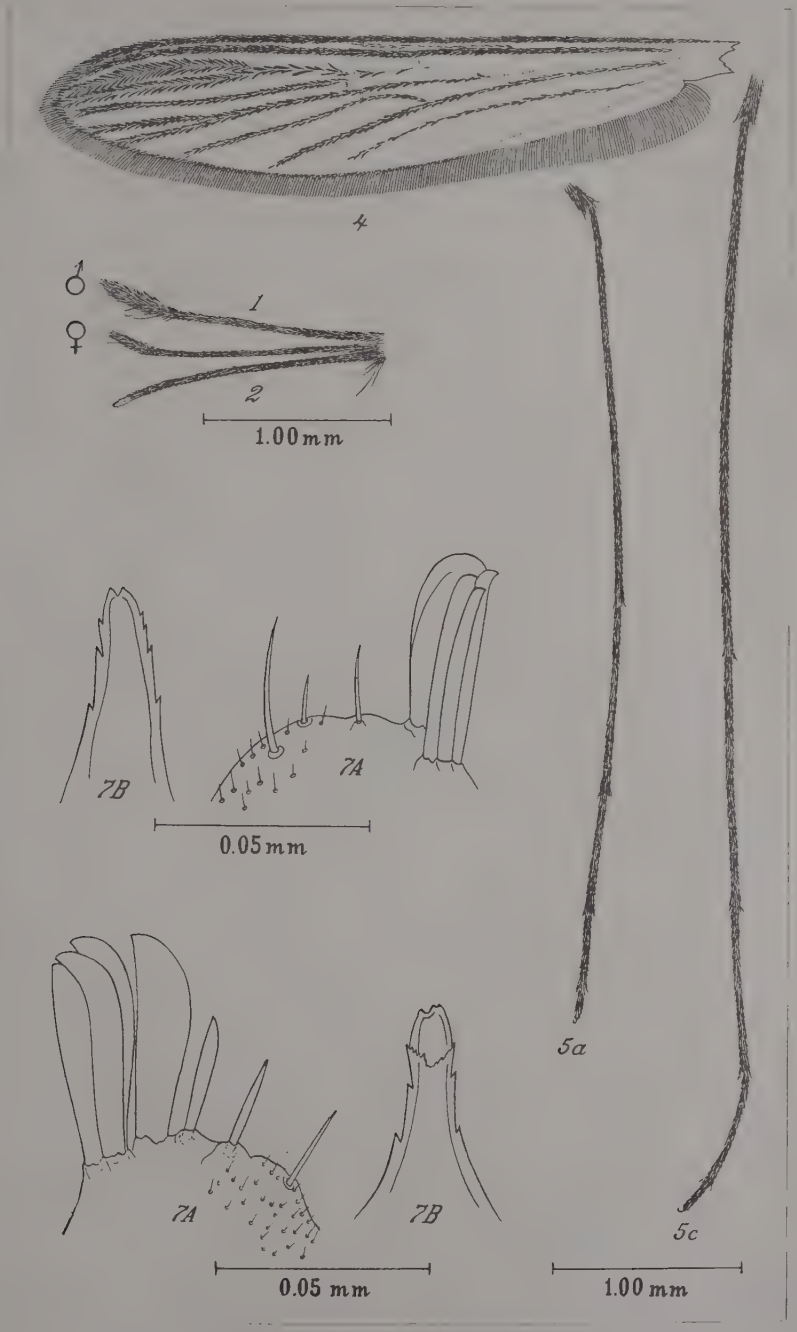

PLATE 3. ANOPHELES INSULÆFLORUM.

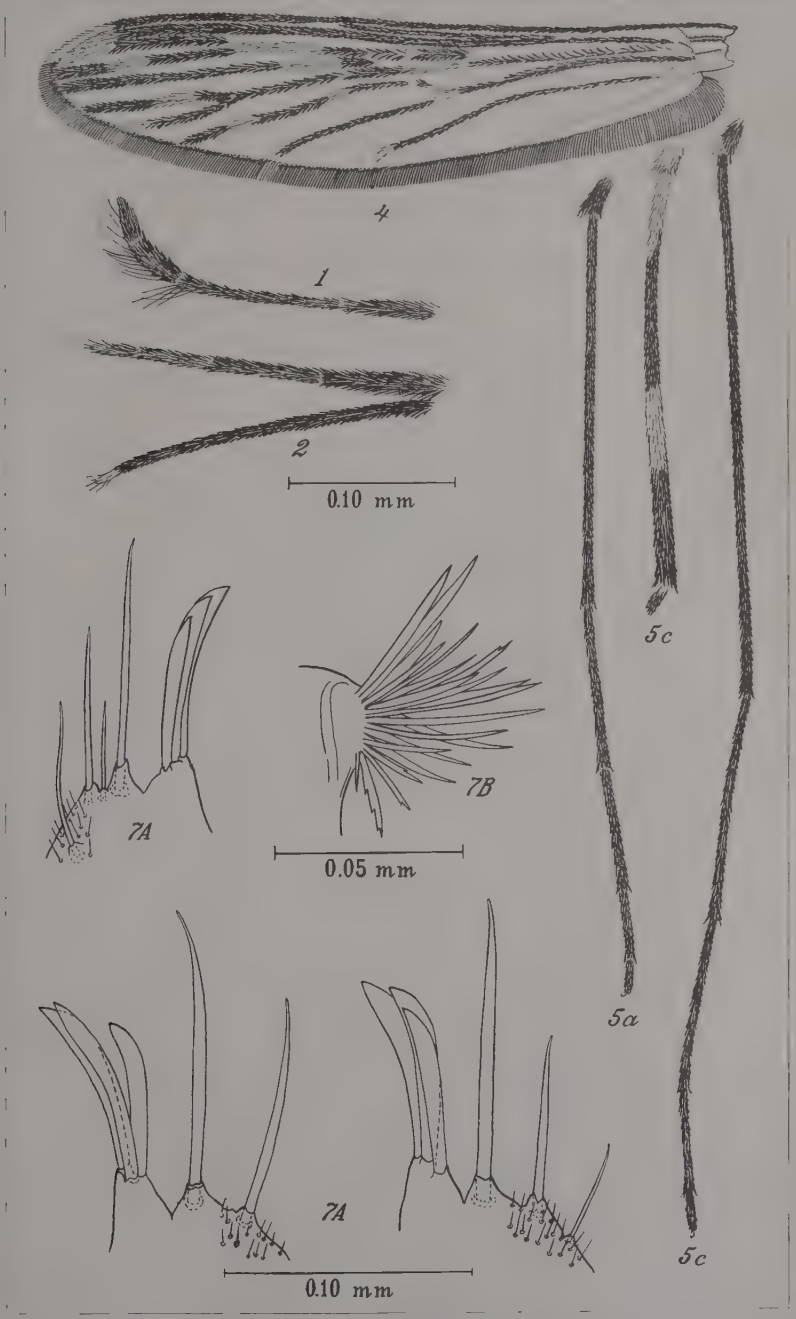

PLATE 4. ANOPHELES LINDESAYI VAR. BENGUETENSIS.

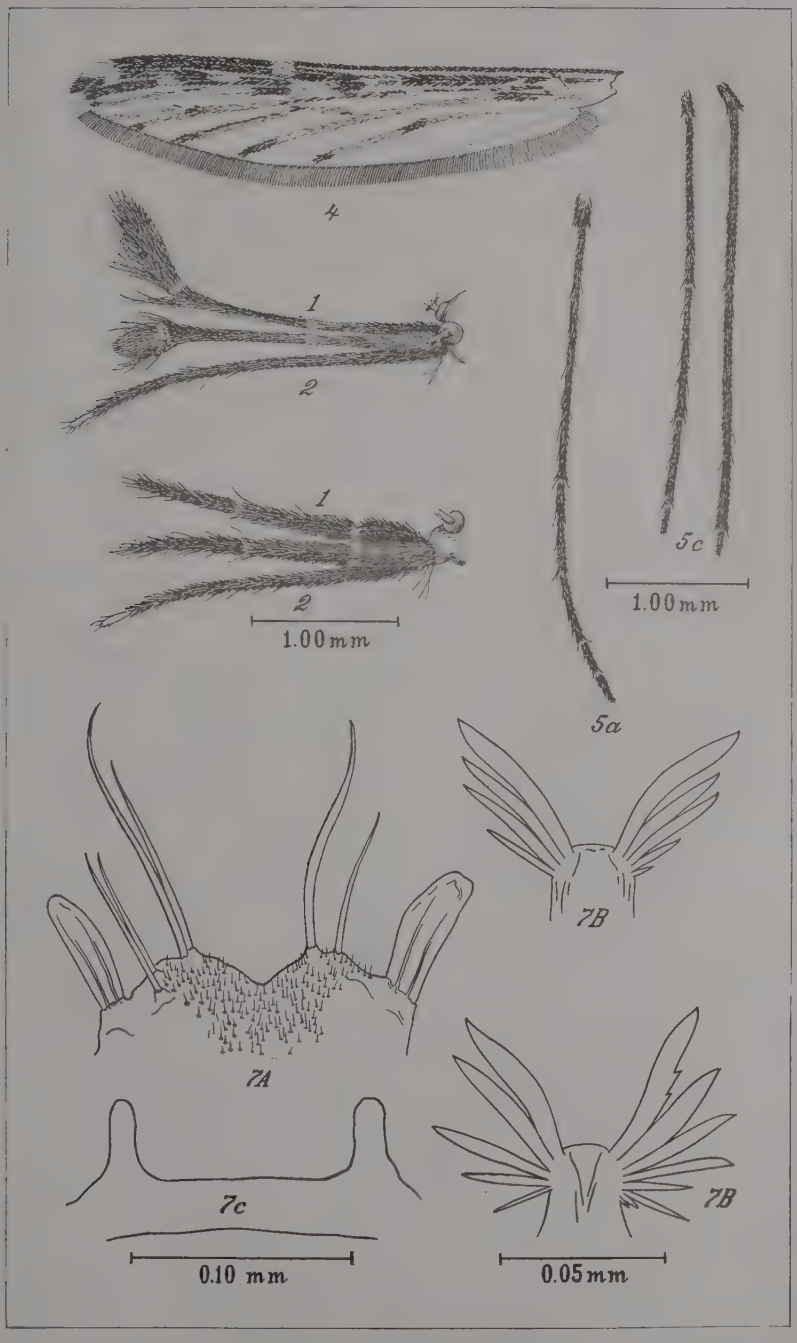

PLATE 5. ANOPHELES BAEZAI.

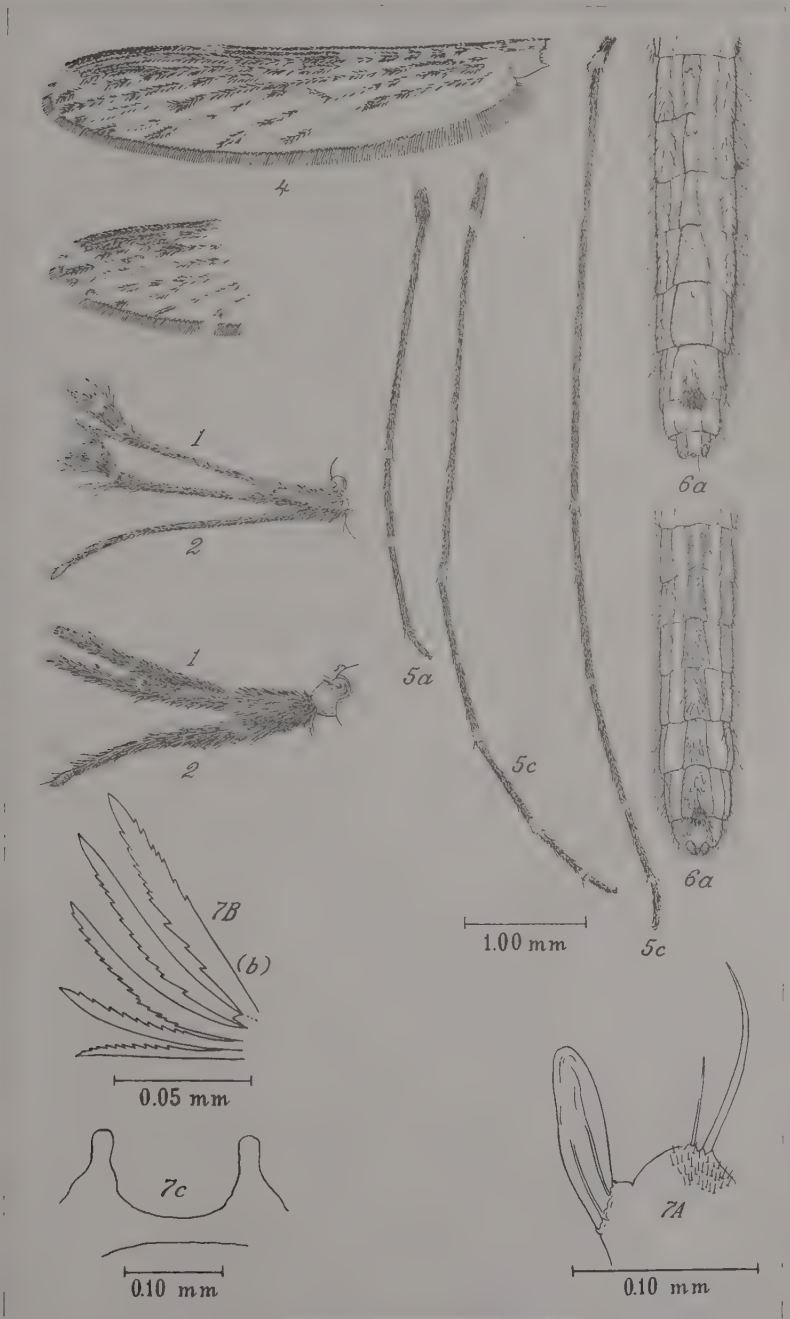

PLATE 6. ANOPHELES BARBIROSTRIS.

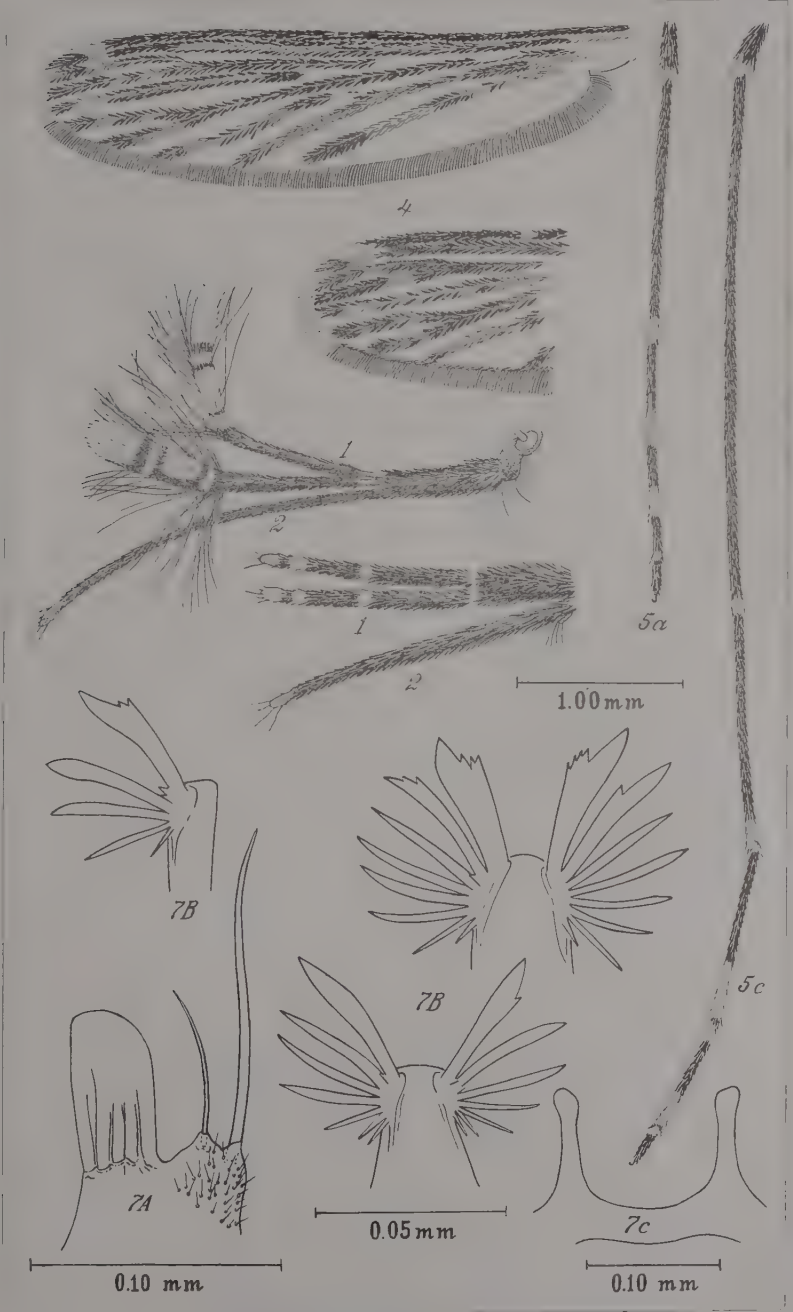

PLATE 7. ANOPHELES HYRCANUS VAR. NIGERRIMUS.

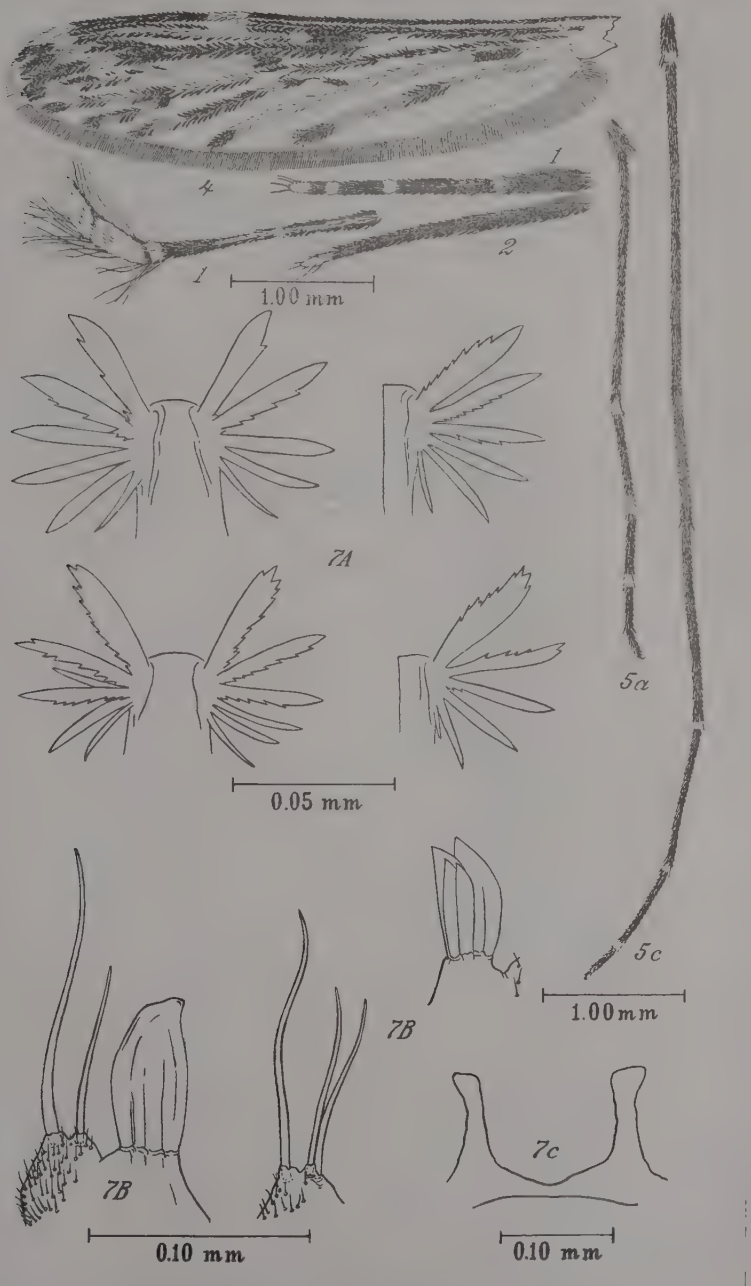

PLATE 8. ANOPHELES HYRCANUS VAR. SINENSIS.

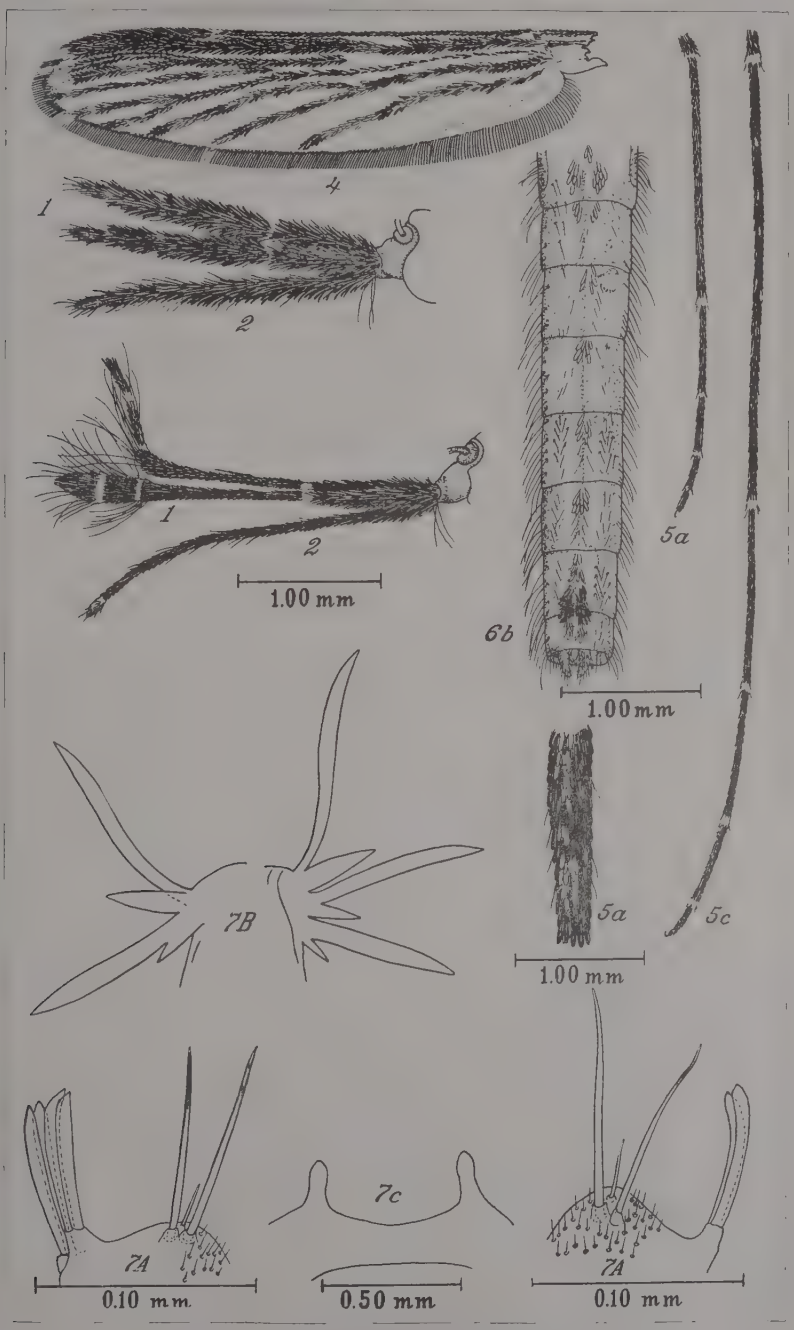

PLATE 9. ANOPHELES PSEUDOBARBIROSTRIS.

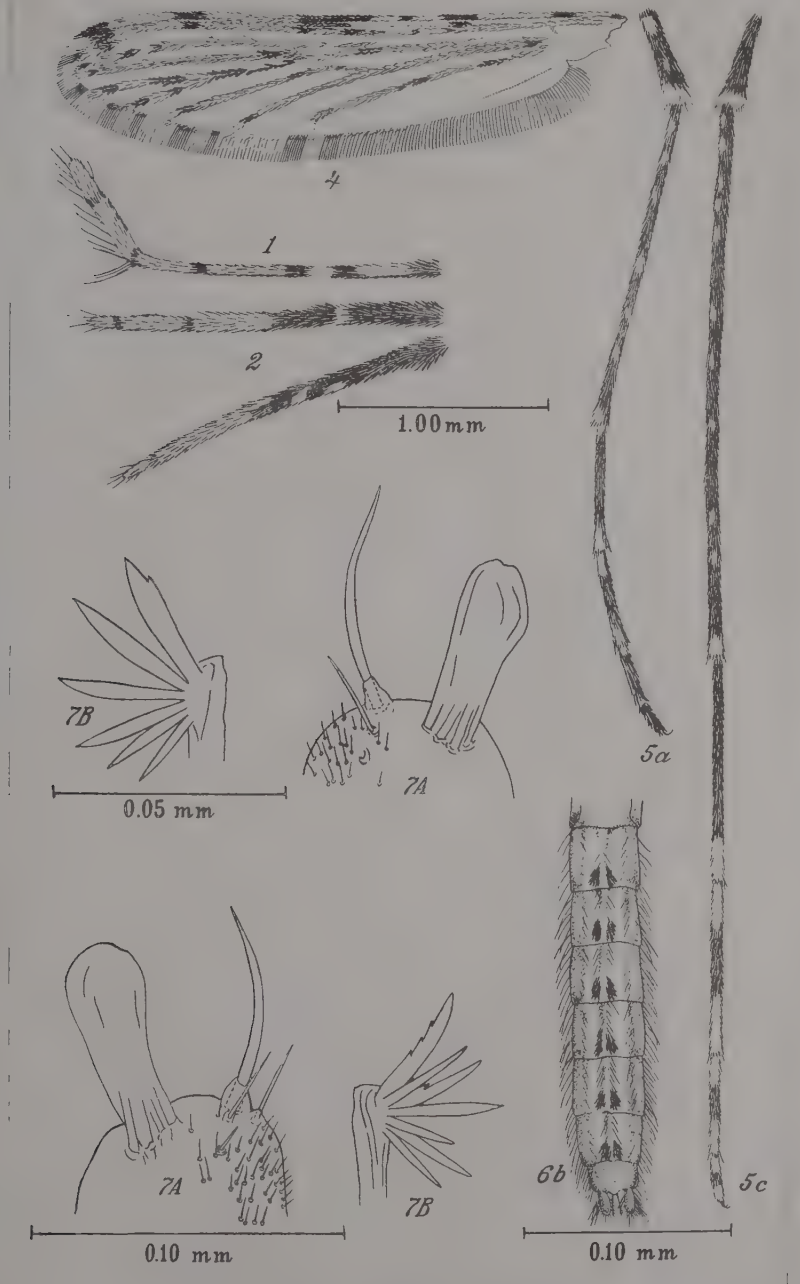

PLATE 10. ANOPHELES KOCHI.

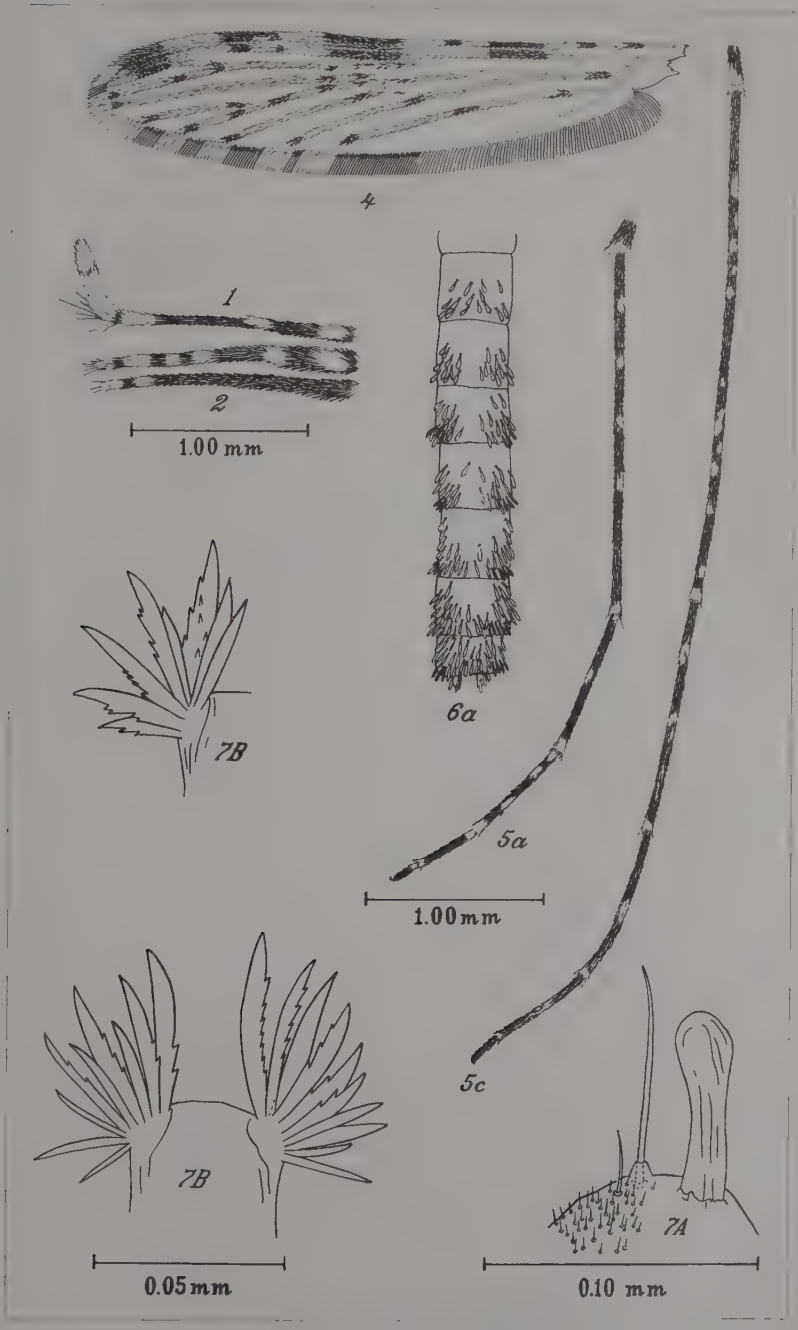

PLATE 11. ANOPHELES KOLAMBUGANENSIS.

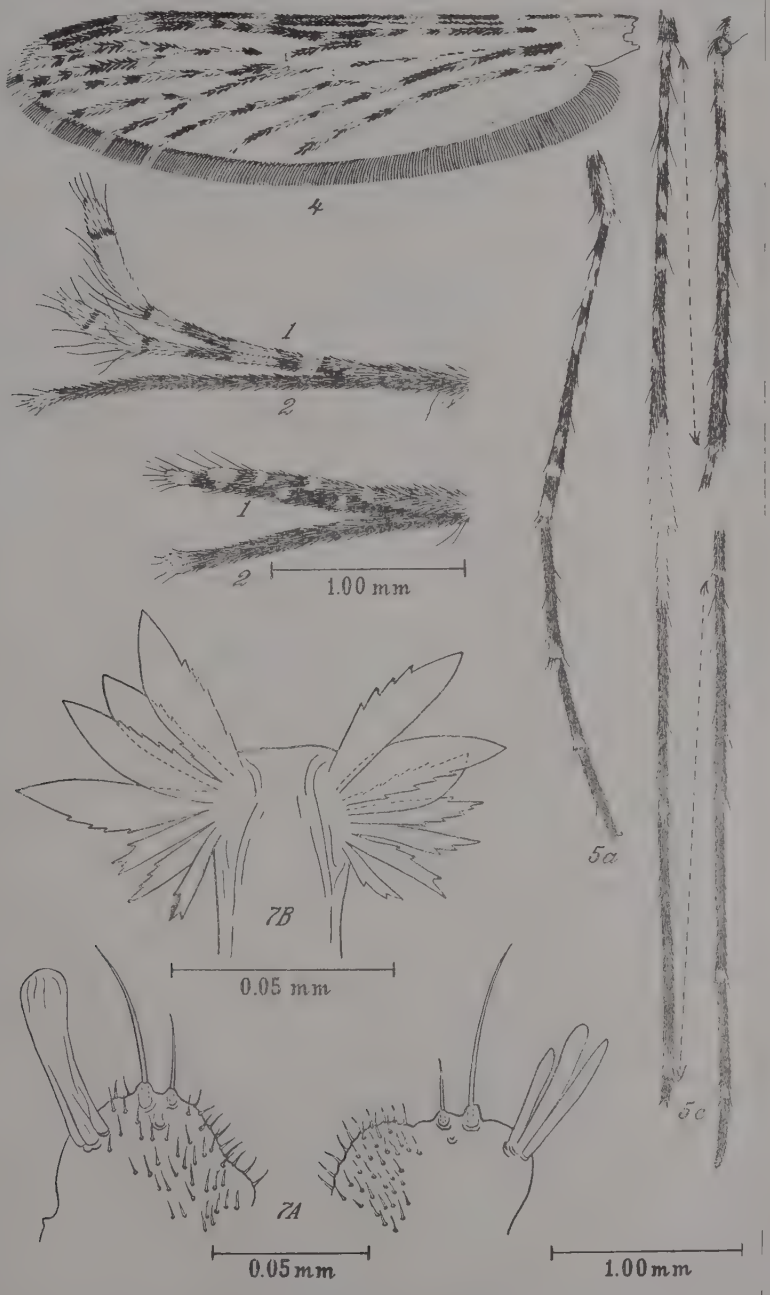

PLATE 12. ANOPHELES LEUCOSPHYRUS.

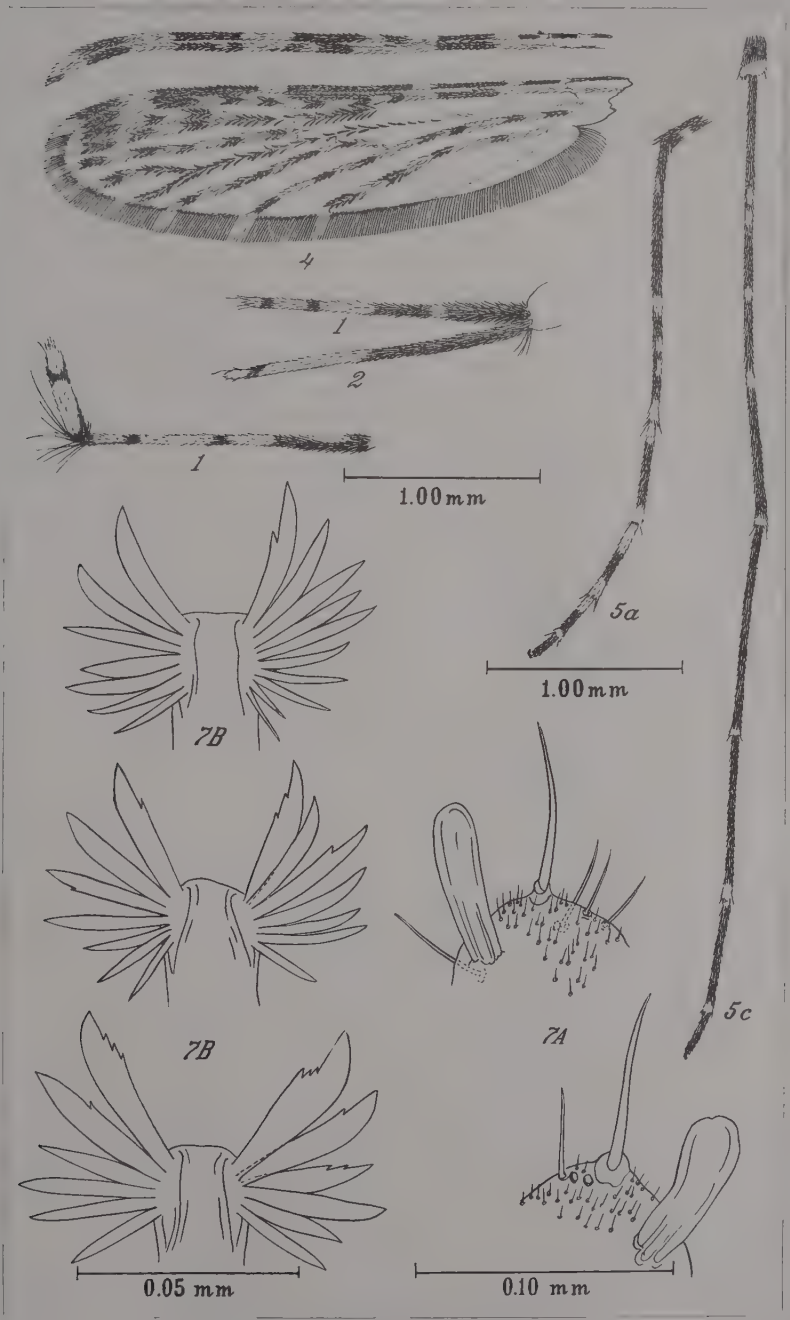

PLATE 13. ANOPHELES TESSELLATUS.

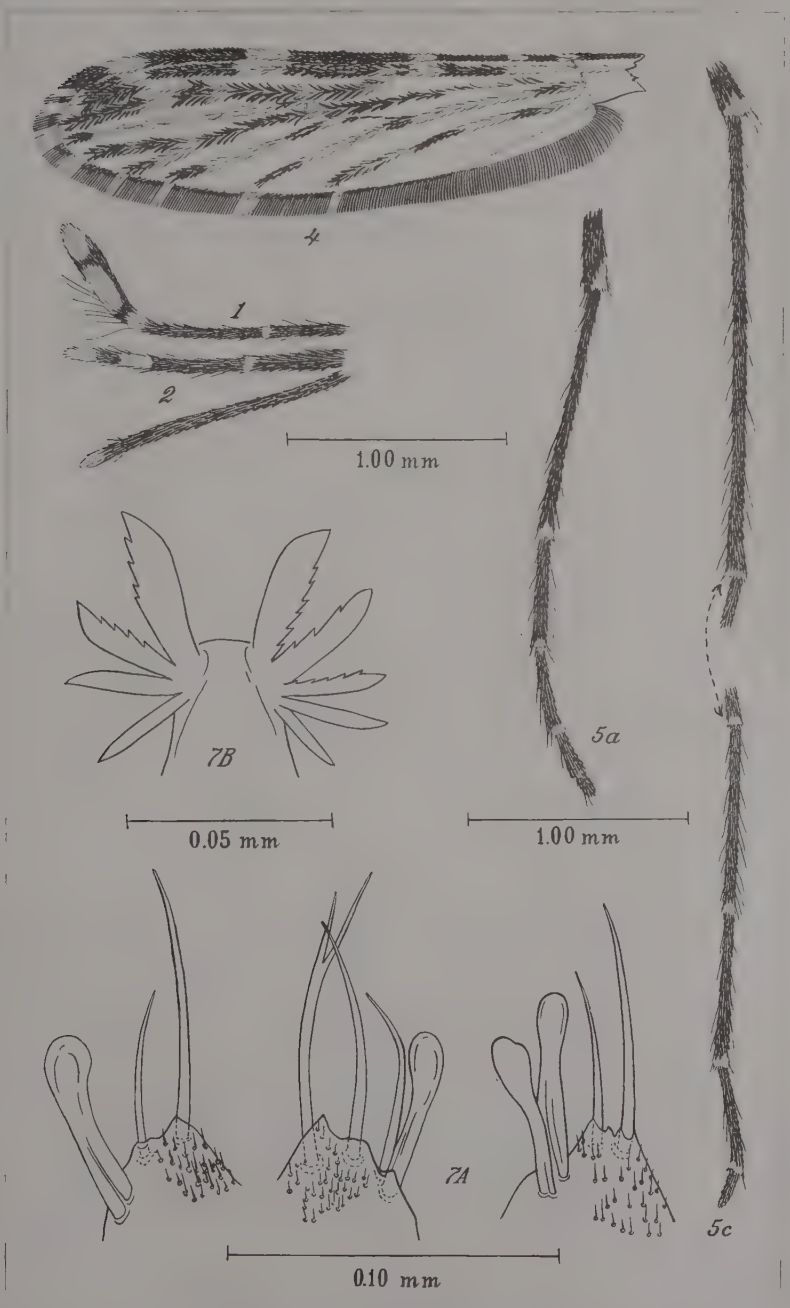

PLATE 14. ANOPHELES FILIPINÆ.

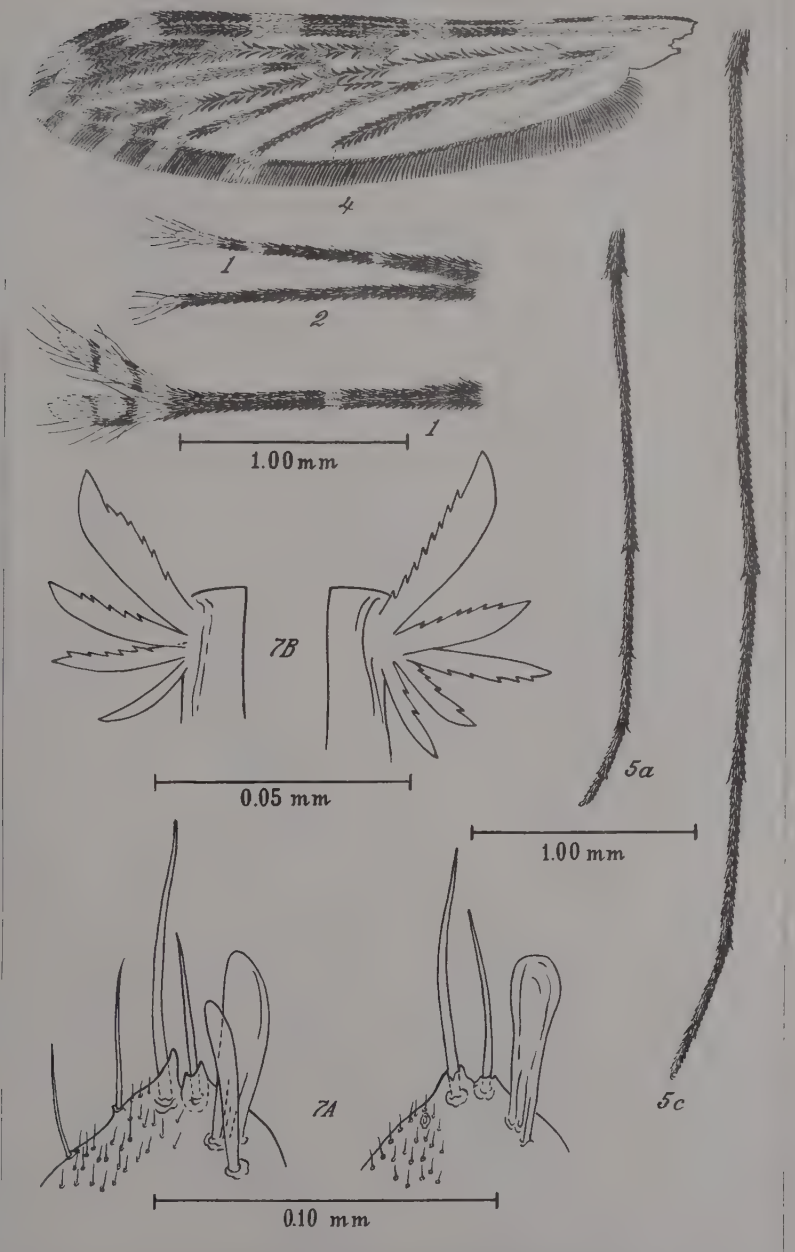

PLATE 15. ANOPHELES MANGYANUS.

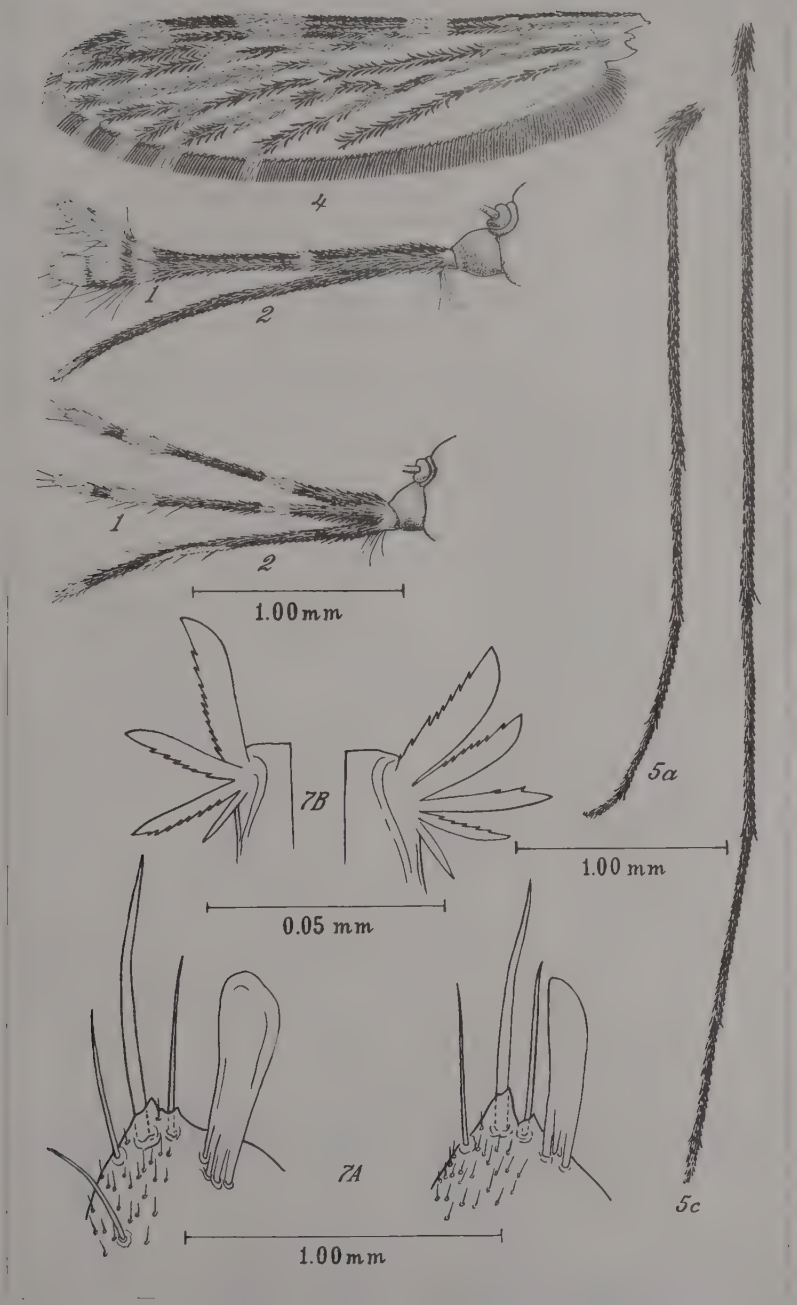

PLATE 16. ANOPHELES MINIMUS VAR. FLAVIROSTRIS.

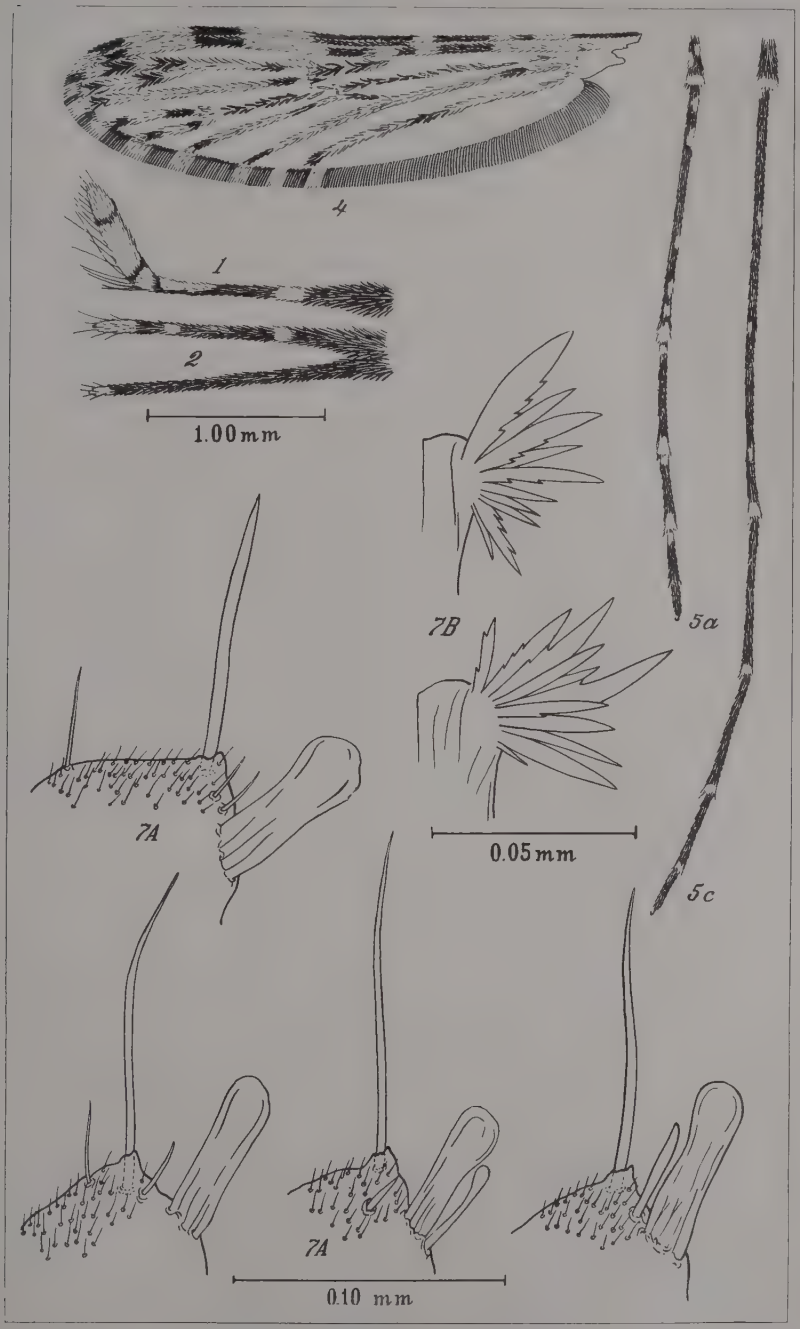

PLATE 17. ANOPHELES LITORALIS.

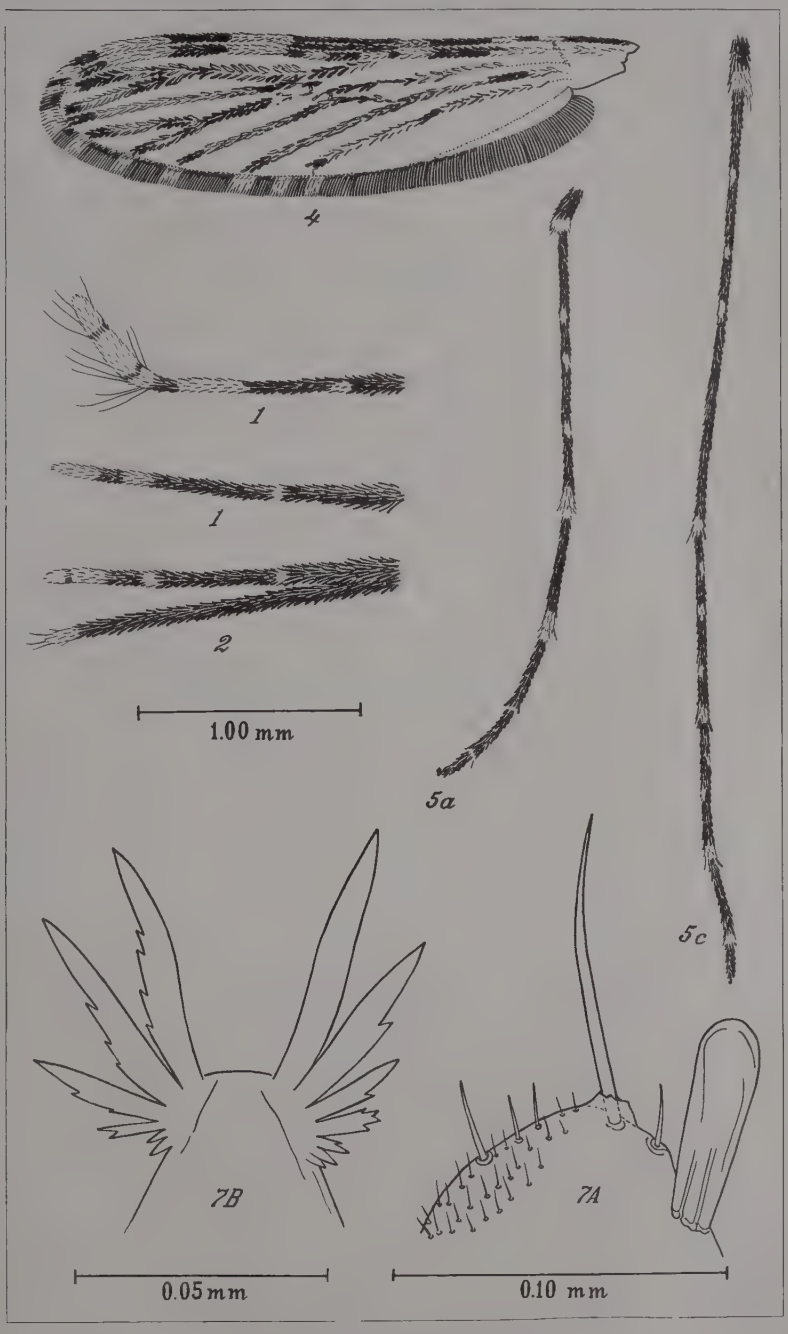

PLATE 18. ANOPHELES LUDLOWI.

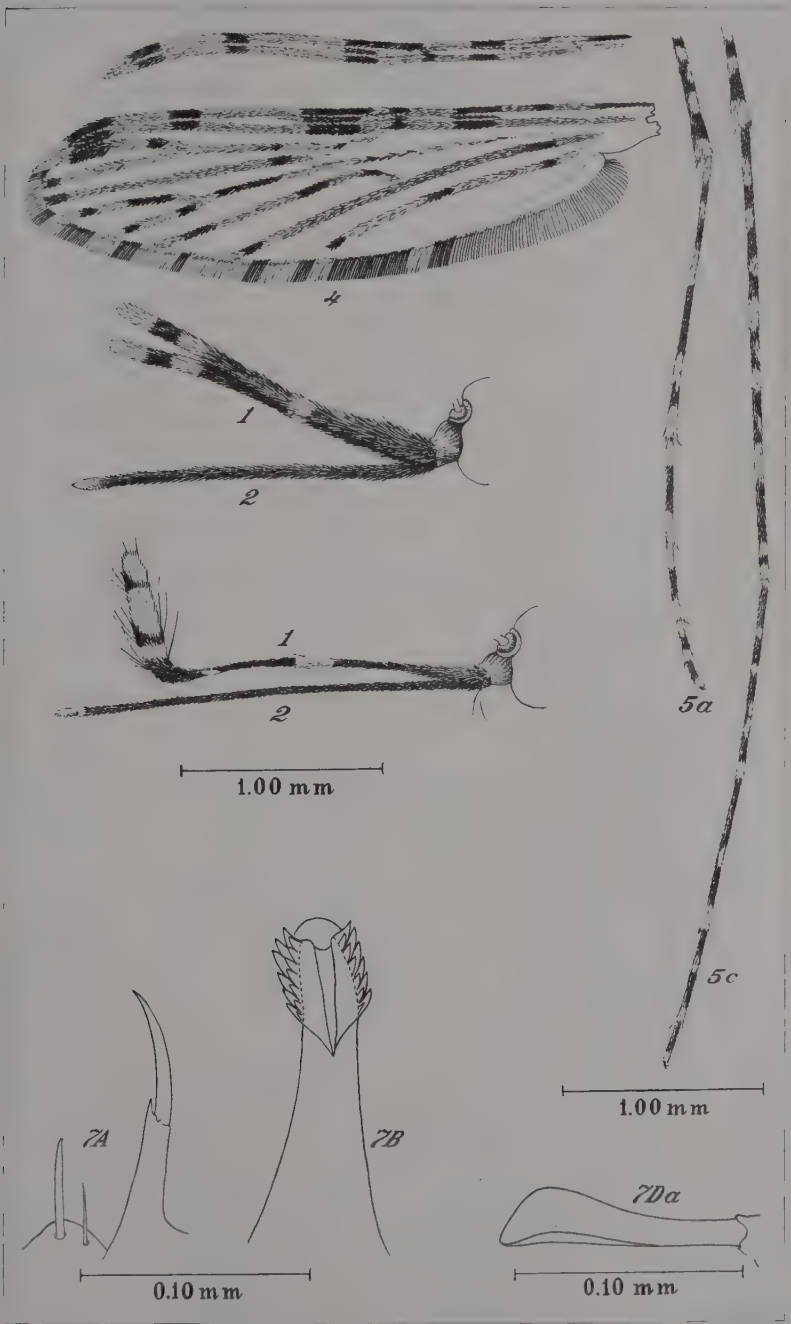

PLATE 19. ANOPHELES PARANGENSIS.

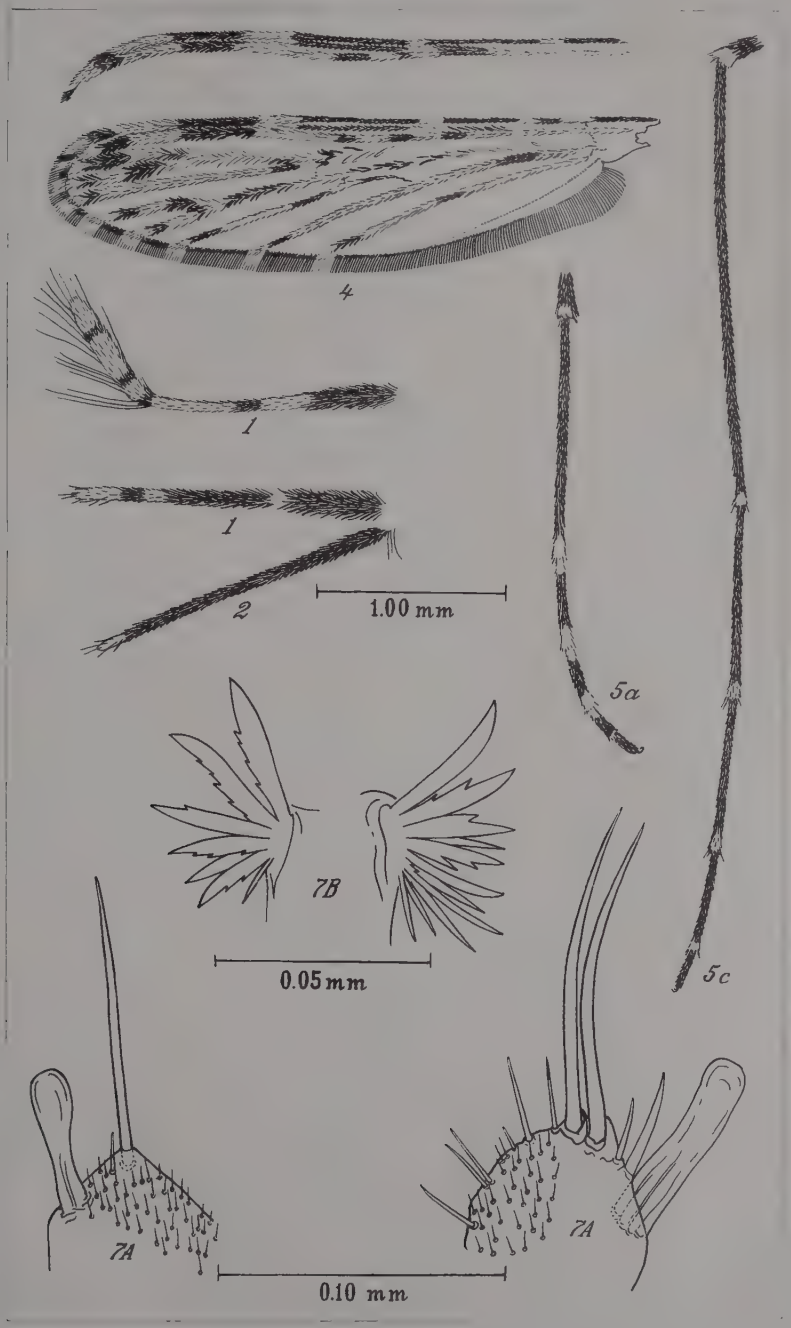

PLATE 20. ANOPHELES SUBPICTUS VAR. INDEFINITUS.

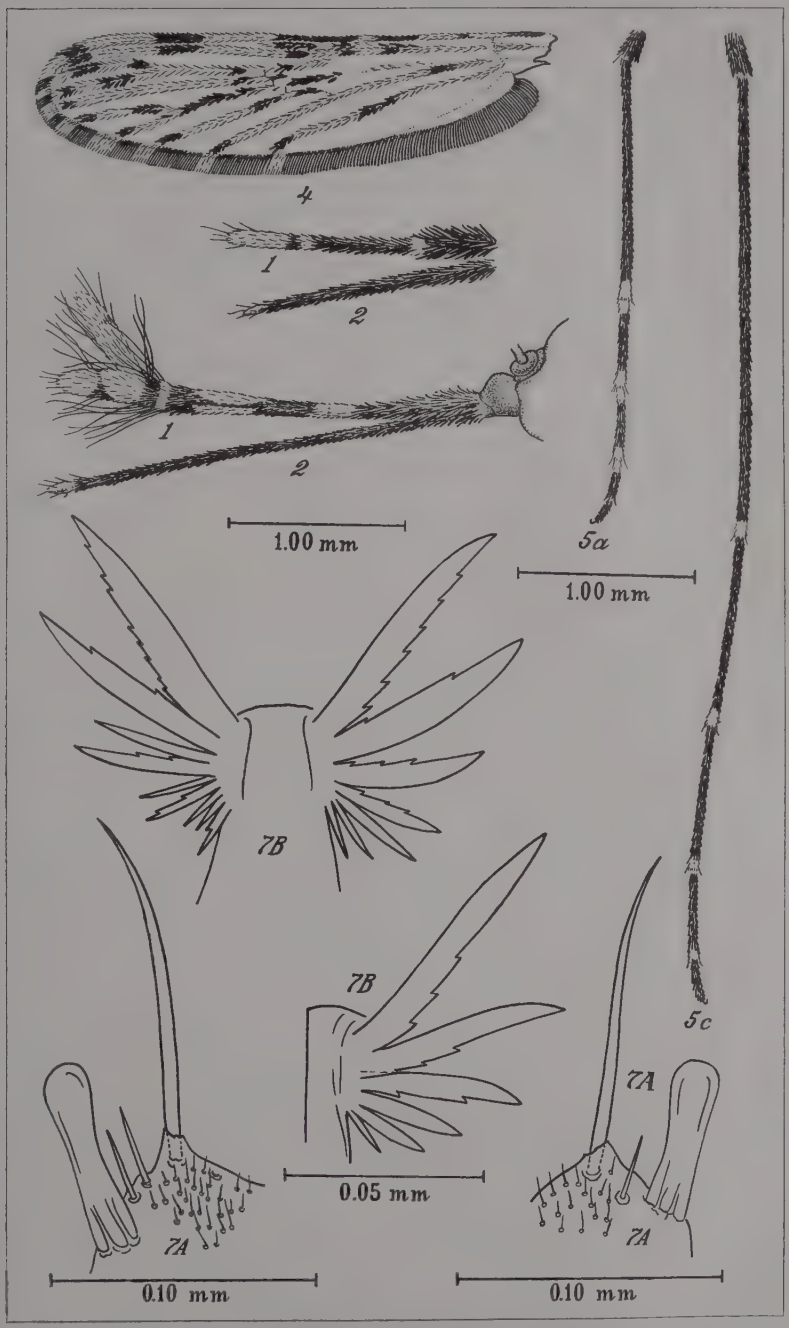

PLATE 21. ANOPHELES VAGUS VAR. LIMOSUS.

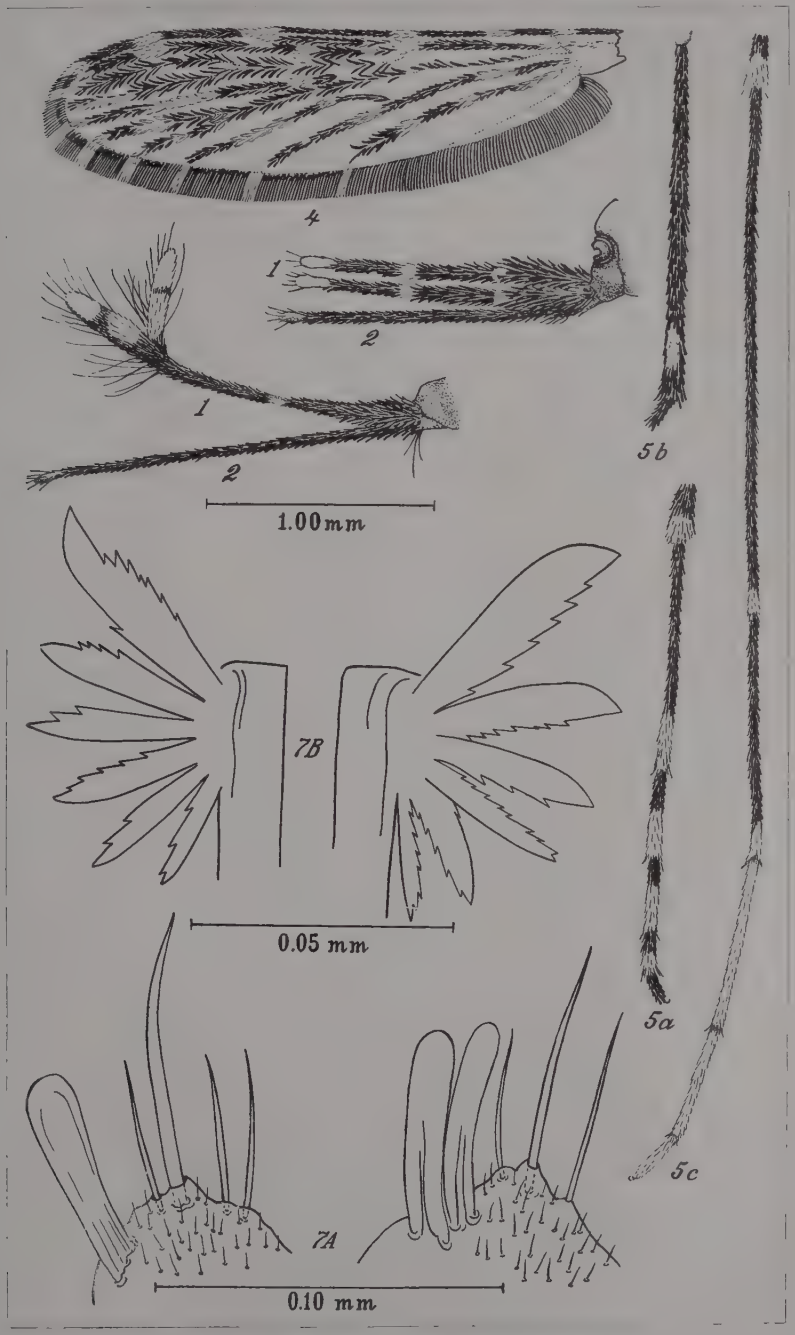

PLATE 22. ANOPHELES ANNULARIS.

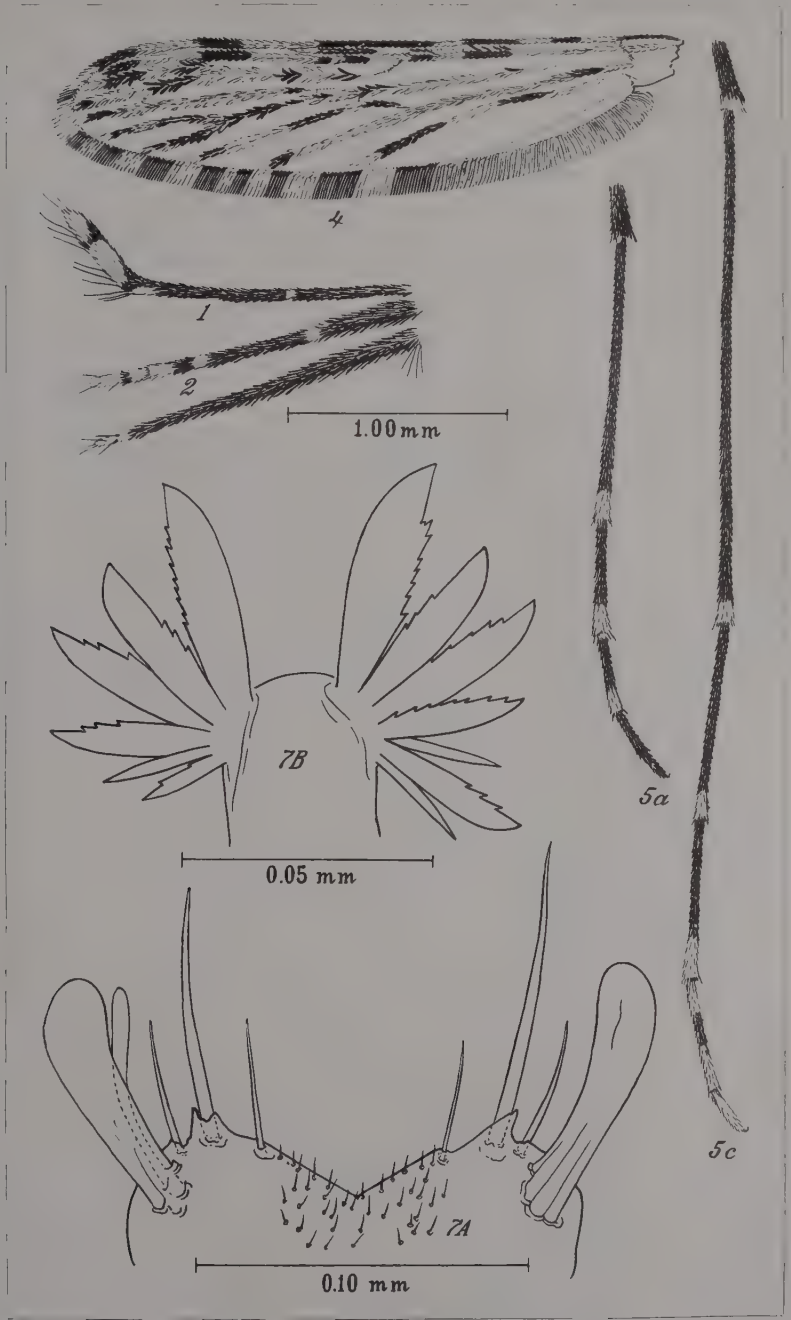

PLATE 23. ANOPHELES KARWARI.

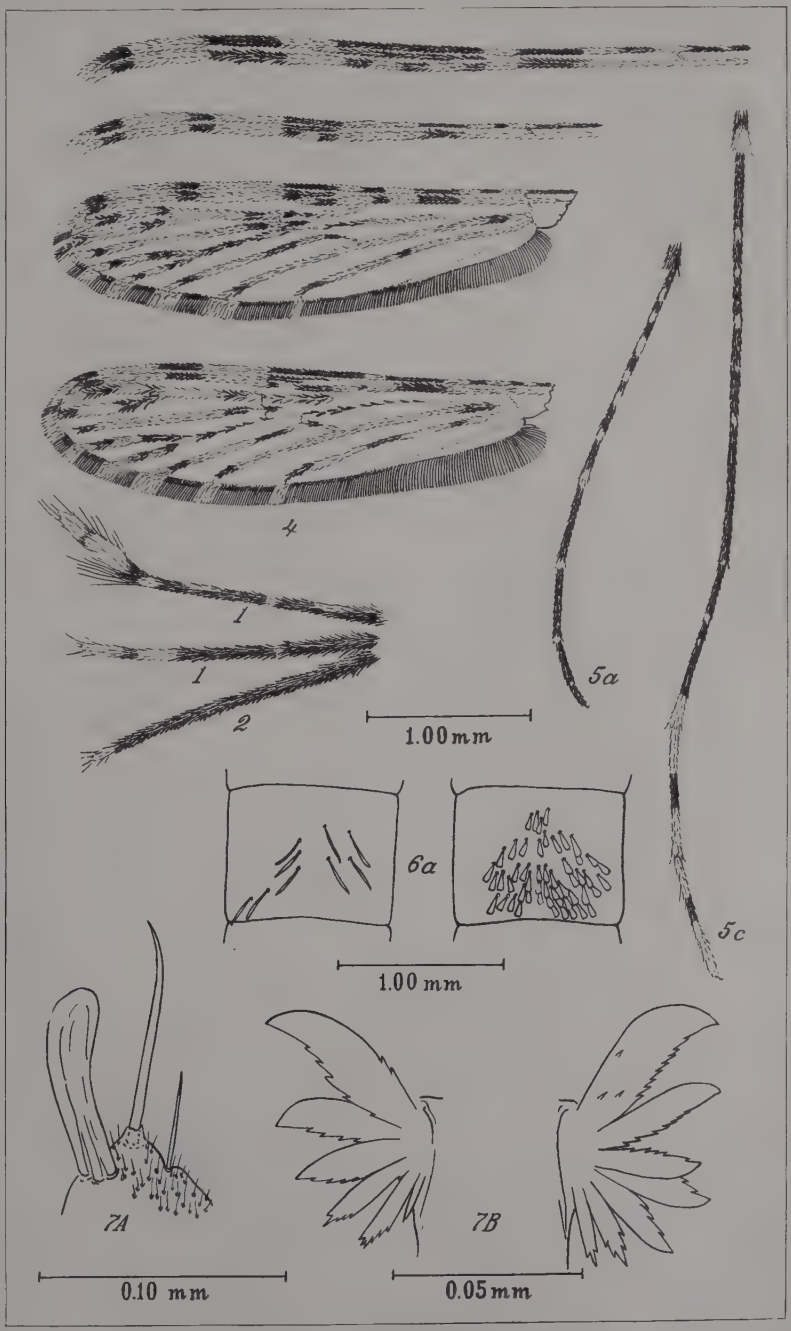

PLATE 24. ANOPHELES MACULATUS.

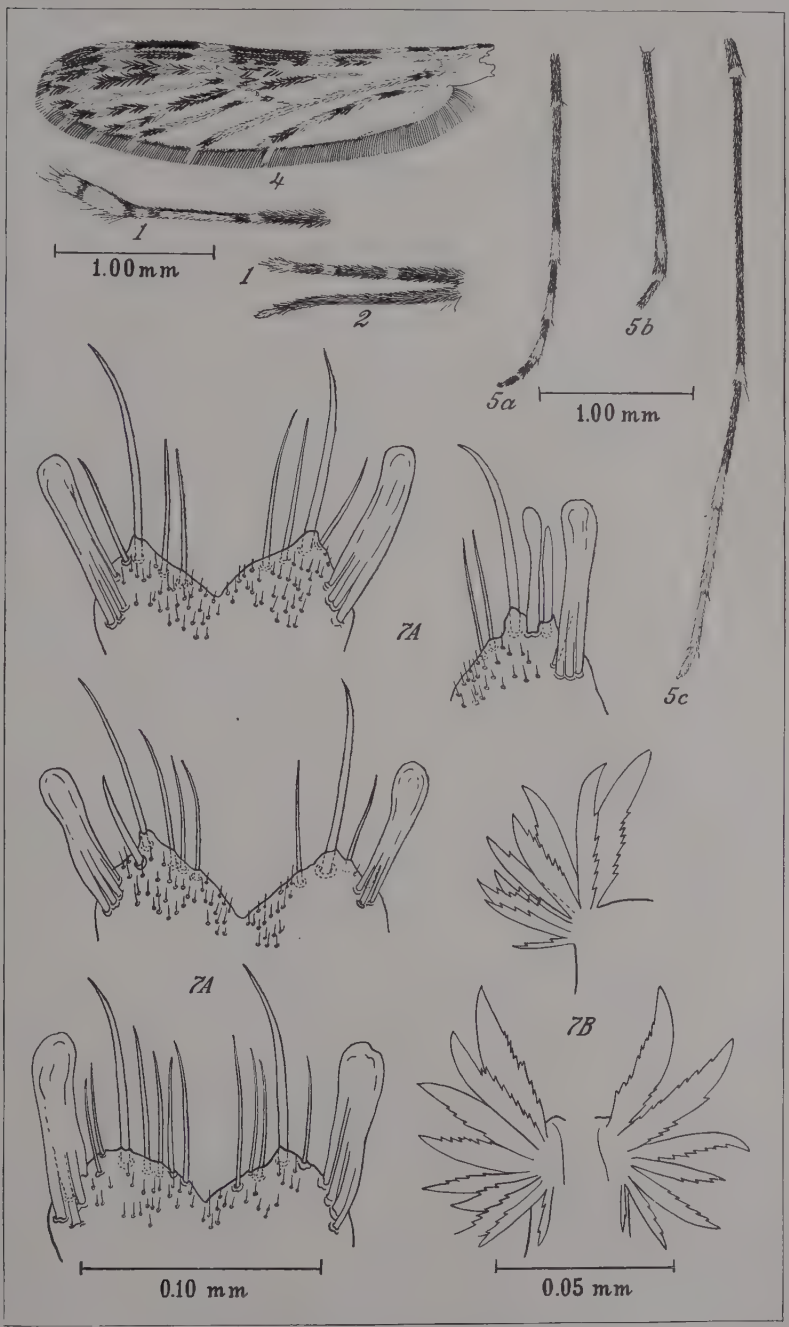

PLATE 25. ANOPHELES PHILIPPINENSIS.

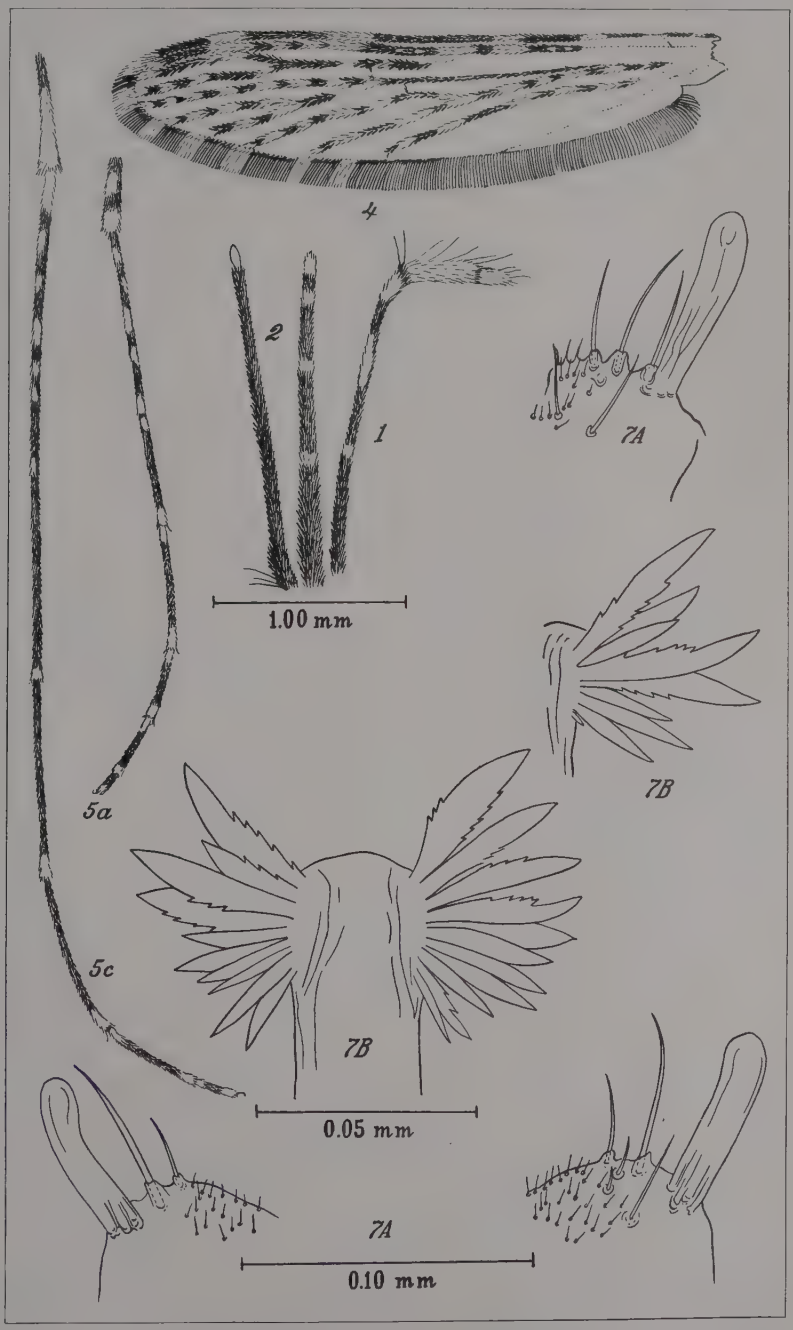

PLATE 26. BALABAC ANOPHELES.

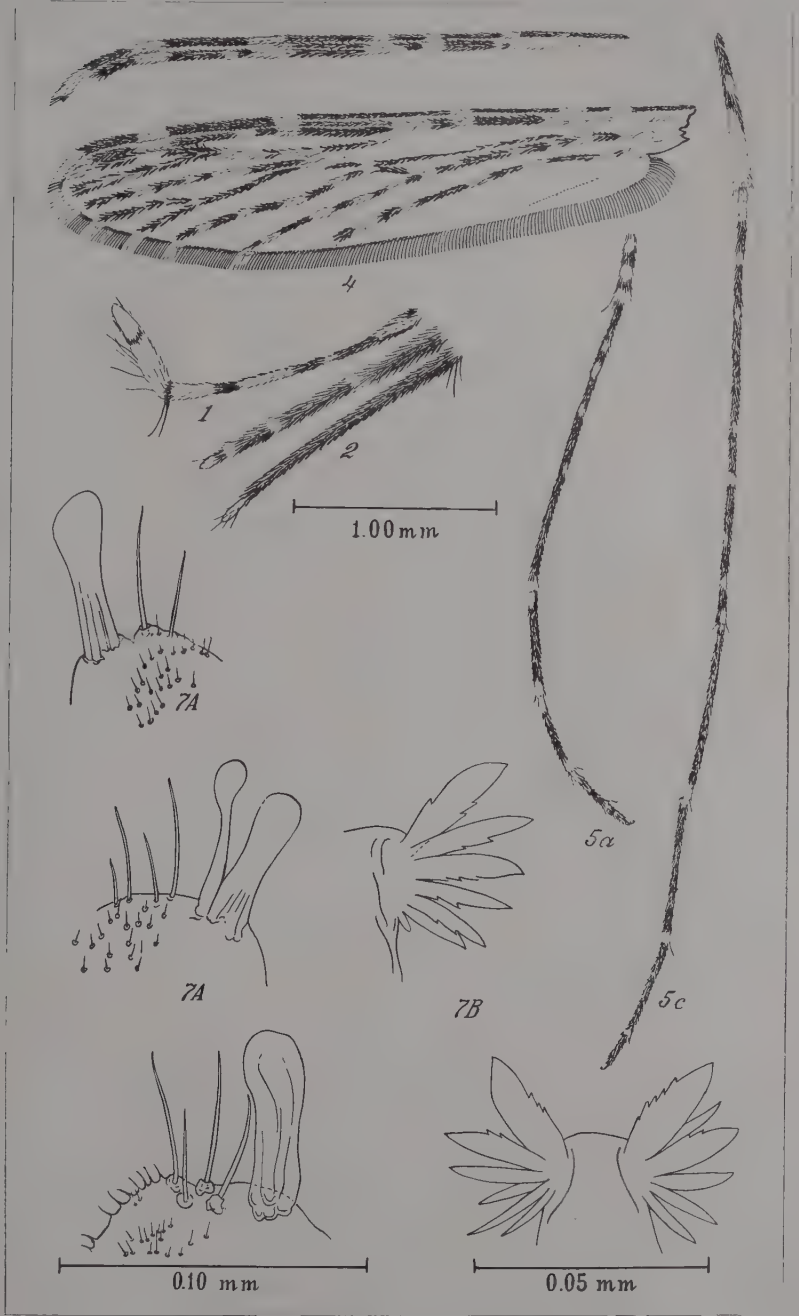

PLATE 27. ANOPHELES NEAR-LEUCOSPHYRUS.

PLATE 28. ANOPHELES MINIMUS VAR. FLAVIROSTRIS.

PLATE 29.

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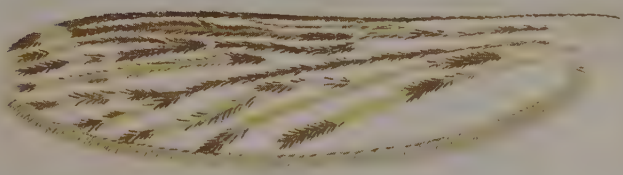

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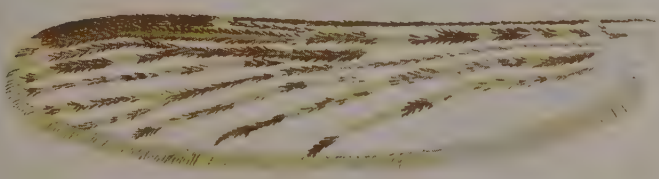

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PLATE 30.

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PLATE 31.

PLATE 32.

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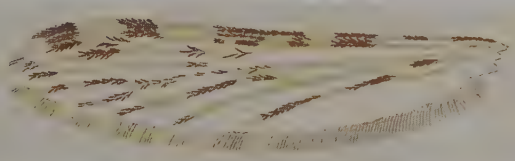

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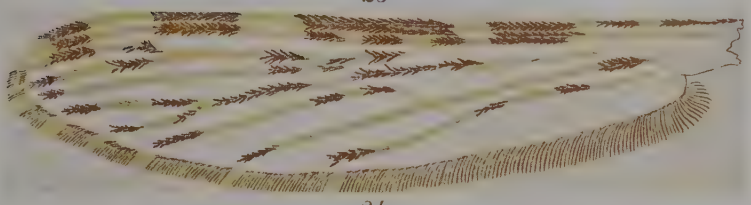

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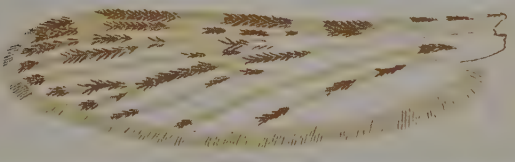

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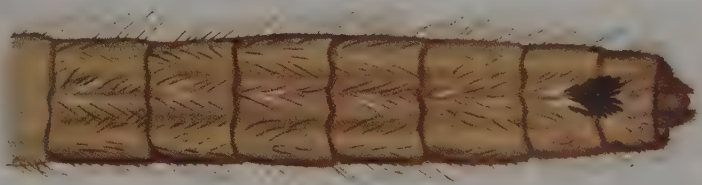
PLATE 33.



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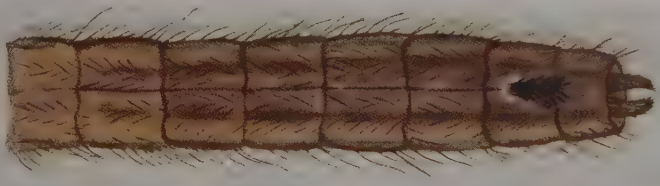

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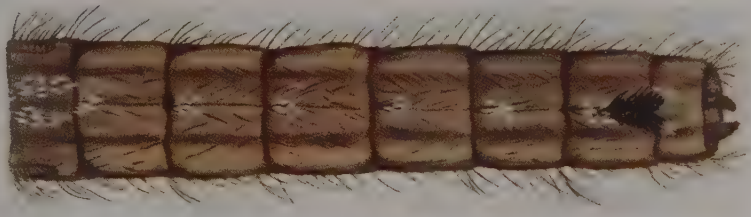

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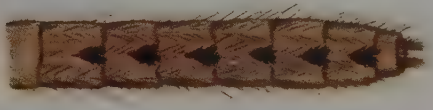

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PLATE 34.

NOTES ON PHILIPPINE MOSQUITOES, IV

THE PUPAL AND CERTAIN ADULT CHARACTERS OF SOME RARE SPECIES OF ANOPHELES [1]

By F. E. Baisas

Of the Bureau of Health, Manila

FIFTEEN PLATES AND ONE TEXT FIGURE

The present paper is an attempt to discover, if possible, further evidence that will justify the separation into species or varieties of the very closely allied members of certain groups of Philippine anopheles. It also includes other species, which do not belong to any particular group in the local anopheline fauna.

THE LEUCOSPHYRUS GROUP

GENERAL CONSIDERATIONS

There are three forms in this group. One, so far as known, is confined to Mindanao; another seems to be restricted to the western islands and has been reported from Palawan and Balabac. The third was at first known only in Luzon, but was later found in greater numbers in Mindanao.

Except Balabac, I have seen the breeding places of these mosquitoes in all the localities named, and have made the greater part of the collections for Dr. W. V. King and Dr. P. F. Russell. I have observed breeding in Mindanao for three consecutive summers, and the only known breeding place of *leucosphyrus* in Luzon has been under my observation for a number of years. We got the first specimens of this species in 1925.

ANOPHELES LEUCOSPHYRUS var. BALABACENSIS var. nov.

I propose to restrict the name *Anopheles leucosphyrus* Dönitz (1901) to the type represented in Luzon and to use *A. leucosphyrus* var. *balabacensis* var. nov. for the variety found in Palawan and Balabac. The type specimens of this, a male (lot R80–34), a female (lot R80–12), and their corresponding larval skins, together with a number of cotypes, are deposited in the

[1] Submitted for publication May, 1935. Parts of these notes dealing the same subject (1934–1935).

collections of the Bureau of Health, Manila. The type locality is Balabac, Balabac Island. Mr. F. Guinto made the collection in June, 1934. Prior to this Dr. P. F. Russell and Mr. Andres Nono secured several larvæ of this mosquito from the same locality, from which, however, no adult emerged.

Anopheles near-*leucosphyrus,* cumbersome and awkward as it is, has to be used until Dr. W. V. King himself has the chance to change it. The very first specimens of this species were given to him. Unfortunately he left the Philippines without having the opportunity to work on them, and could only assign the provisional designation by which the species is now known.

In breeding habits near-*leucosphyrus* is distinct. It was once found breeding in a tree hole, the only instance of this kind among anopheles in the Philippines. Moreover, it consistently breeds in rock holes, and has not been found in any other situation although there are nice nooks along the edges of the creek, which look very much like rock holes. Undoubtedly it will breed in any other creek where similar conditions exist, but it is rather strange that in the considerable forest area and the numerous streams that I have seen in Mindanao only one creek was found harboring near-*leucosphyrus.* Judging from its very limited range of breeding habits, it may be supposed that this species will be exterminated by the rapid deforestation that is taking place in the locality where it breeds. It has not been found breeding heavily at any one time.

Anopheles leucosphyrus, as found in Luzon and Mindanao, breeds in rock holes and in quiet corners of forest creeks; but it seems best suited to larger stagnated portions of forest streams and even rivers with plenty of débris and well shaded by trees. In the last type of situation I have found it breeding in numbers reaching a hundred larvæ on more than one occasion and in more than one stream. In Luzon it has been known to breed very scantily. At only one time—January 7, 1935—have I found more than twenty larvæ in a single stagnated portion of the creek where it breeds. Usually only one to six larvæ can be found in the whole creek at any one time. In both Luzon and Mindanao breeding of *leucosphyrus* is markedly seasonal.

A kind of larva that is intermediate in character between near-*leucosphyrus* and *leucosphyrus* has been found two or three times breeding with near-*leucosphyrus* in rock holes. I have not, however, succeeded in obtaining adult males from such larvæ. It would be interesting to find out if such intermediate peculiarities signify anything at all in the adult.

Anopheles leucosphyrus var. *balabacensis* is closest to the *leucosphyrus* of other countries in breeding habits. It has been found in quiet corners of forest creeks, in clear pools left in beds of temporary forest streams, and in open forest pools away from streams. It seems to be the heaviest breeder of the three forms.

THE LARVÆ

For larval characters and differentiation between the forms, the reader is referred to Russell and Baisas's paper.[2]

THE PUPÆ[3]

Variations in the branching of the pupal hairs are considerable. Even in single individuals the hairs on one side vary greatly from those on the other. However, certain characters have been found useful in differential diagnosis of the forms under the group. Spine *A* of abdominal segments II to VI of *leucosphyrus* is always simple; that on VII may sometimes be branched. In near-*leucosphyrus* and in var. *balabacensis* this spine is usually branched on segments V to VII. Occasionally even that on IV is branched. In some instances one or more of these spines on one or more segments may be simple, but the majority have been found branched. Hair *B* of abdominal segments V to VII is usually less branched in var. *balabacensis* than in either of the other two forms. To separate var. *balabacensis* from near-*leucosphyrus* two or three characters may be used. The respiratory trumpets of near-*leucosphyrus* are narrower than those of var. *balabacensis*. Hair *O* of the metathorax in var. *balabacensis* is usually less branched than that in near-*leucosphyrus*, while hair *C* of abdominal segment II often has more branches in *balabacensis* than in near-*leucosphyrus*. The branches of this hair in near-*leucosphyrus* are arranged generally in one plane like a fan, whereas those in the other two

[2] Philip. Journ. Sci. 55 (December, 1934). Plates 14, 27, and 28 of that paper illustrate the typical forms and Plate 29, fig. F, shows the intermediate type.

[3] The nomenclature employed in this paper for pupal characters is in accordance with Senevet (1930, pp. 71–74), as modified by Christophers (1933, pp. 32–34). Plates 1 and 2 show the designation of parts. In the drawings the scalelike coverings of the inner and outer surfaces of the respiratory trumpets have been omitted. A pair of very short hairs is present on the anterior part of the ventral side on segments IV to VIII of the abdomen. I refer to these as hair 9. Senevet (1932) designates them by the symbol ξ.

TABLE 1.—*Pupal characters in the Anopheles leucosphyrus group.*

	Hairs.	*Anopheles leucosphyrus.*				*Anopheles leucosphyrus* var. *balabacensis.*				*Anopheles* near-*leucosphyrus.*			
		Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.
Metathorax	R	16	1– 2	1.4	1	19	1– 3	2.2	2	24	2– 6	3.3	3
Do	P	15	1– 3	2.0	2	19	1– 4	2.9	3	24	2– 4	2.5	2
Do	O	16	1– 4	2.1	2	20	2– 6	2.0	2	21	4–10	5.6	5
Abdominal segment I	H	14	1– 1	1.0	1	20	1– 2	1.0	1	23	1– 3	1.9	2
Do	K	11	4– 7	6.0	7	19	4– 8	6.0	6	22	5– 9	6.0	6
Do	L	16	1– 6	3.8	4	20	3– 7	4.9	5	23	3– 7	4.3	4
Do	M	15	1– 4	2.1	2	20	3– 5	3.6	3	23	2– 5	3.4	3
Do	S	16	2– 4	2.8	3	20	3– 5	4.2	4	23	2– 6	3.9	3
Do	T	16	1– 2	1.1	1	20	1– 3	2.0	2	24	1– 3	2.3	3
Do	U	16	1– 1	1.0	1	20	1– 1	1.0	1	24	1– 1	1.0	1
Abdominal segment II	A	Very tiny, blunt.				Very tiny, blunt.				Very tiny, blunt.			
Do	C	14	14–27	17.1	18	19	16–43	25.1	25	22	7–16	11.4	11
Do	1	16	1– 2	1.5	2	19	1– 3	1.9	2	22	1– 3	1.5	1
Do	1	16	2– 4	3.0	3	18	3– 5	3.6	4	20	3– 6	4.8	5
Do	2	16	2– 3	2.1	2	20	2– 6	3.9	4	23	1– 3	2.3	2
Do	2	14	2– 5	3.4	4	18	5– 6	5.4	5	22	4– 8	5.1	5
Do	3	16	2– 4	2.9	3	19	2– 6	3.1	3	23	2– 6	3.3	3
Do	4	14	3– 5	3.4	3	20	5– 7	5.6	6	21	4– 7	4.5	4
Do	5	16	1– 1	1.0	1	20	1– 1	1.0	1	21	1– 1	1.0	1
Abdominal segment III (dorsal)	A	Tiny, blunt				Tiny, blunt				Tiny, blunt.			
Do	B	13	4– 6	5.1	5	20	8–12	9.3	9	22	6–12	7.5	7
Do	C	15	4– 8	5.4	5	20	7–11	8.3	8	23	6–17	8.7	7
Do	1	16	1– 2	1.3	1	20	1– 3	2.1	2	23	1– 3	1.7	2
Do	2	14	2– 5	3.1	3	20	3– 6	3.9	4	23	2– 5	3.7	4
Do	3	16	2– 4	2.9	3	17	3– 6	3.7	4	24	2– 9	4.0	4
Do	4	15	3– 5	4.0	4	20	5– 7	5.6	5	24	2– 6	4.0	4
Do	5	16	1– 1	1.0	1	20	1– 1	1.0	1	24	1– 1	1.0	1

Abdominal segment III (ventral)	E	4	2– 3	2.1	2	8	2– 4	2.2	2	7	2– 3	2.3	2
Do	6	4	1– 2	1.9	2	8	2– 3	2.5	3	8	2– 5	3.5	4
Do	7	4	2– 3	2.9	3	8	3– 5	3.9	4	8	2– 5	3.8	4
Do	8	4	1– 1	1.0	1	8	1– 1	1.0	1	8	1– 1	1.0	1
Abdominal segment IV (dorsal)	A	Fairly long, simple.				Fairly long, sometimes branched.				Fairly long, simple.			
Do	B	16	4– 6	4.5	4	20	6–10	7.7	8	23	6–12	7.6	7
Do	C	15	3– 4	3.1	3	18	5– 8	6.4	6	24	3– 8	5.3	5
Do	1	14	1– 1	1.0	1	19	1– 2	1.1	1	22	1– 3	1.9	2
Do	2	14	2– 4	2.9	3	20	1– 5	2.5	3	22	2– 7	3.9	5
Do	3	15	2– 6	4.7	5	20	5–10	8.1	8	23	4–11	7.2	6
Do	4	14	1– 3	2.4	3	19	3– 5	4.2	4	24	2– 4	2.7	3
Do	5	16	1– 1	1.0	1	20	1– 1	1.0	1	24	1– 1	1.0	1
Abdominal segment IV (ventral)	E	4	1– 1	1.0	1	7	1– 2	1.5	2	7	2– 3	2.4	2
Do	6	4	2– 3	2.1	2	8	2– 3	2.2	2	8	2– 4	2.6	3
Do	7	4	2– 3	2.1	2	8	3– 4	3.6	4	8	3– 5	3.7	3
Do	8	4	1– 1	1.0	1	8	1– 1	1.0	1	8	1– 1	1.0	1
Do	9	4	1– 1	1.0	1	8	1– 1	1.0	1	8	1– 1	1.0	1
Abdominal segment V (dorsal)	A	Simple.				Usually branched.				Branched.			
Do	B	16	3– 5	4.2	4	20	5– 9	6.8	7	19	6–11	8.7	9
Do	C	16	2– 3	2.1	2	19	2– 5	3.2	3	24	2– 5	3.4	4
Do	1	16	1– 1	1.0	1	20	1– 1	1.0	1	24	1– 3	1.8	2
Do	2	14	1– 4	2.6	3	19	1– 5	3.3	4	24	1– 4	3.1	4
Do	3	15	2– 4	2.8	3	20	2– 3	2.7	3	24	1– 5	2.8	3
Do	4	16	1– 4	1.9	2	20	3– 5	3.9	4	24	1– 3	2.4	3
Do	5	16	1– 1	1.0	1	20	1– 1	1.0	1	24	1– 1	1.0	1
Do	D	3	3– 3	3.0	3	7	2– 4	2.8	3	8	2– 4	2.9	3
Do	E	4	1– 2	1.5	2	8	1– 2	1.8	2	8	2– 3	2.1	2
Do	6	4	1– 2	1.5	2	8	2– 3	2.1	2	8	1– 3	2.4	3
Do	8	4	1– 1	1.0	1	8	1– 1	1.0	1	8	1– 1	1.0	1
Do	9	4	1– 1	1.0	1	8	1– 1	1.0	1	8	1– 1	1.0	1
Abdominal segment VI (dorsal)	A	Long, simple.				Long, branched.				Long, branched.			
Do	B	16	3– 5	4 3	5	19	5– 9	6.8	7	19	5–12	8.6	9
Do	C	16	1– 2	1.3	1	20	2– 4	2.5	2	21	1– 6	3.4	4
Do	C′	16	1– 3	2 3	2	20	1– 3	2.0	2	23	1– 3	1.6	2
Do	1	16	1– 2	1.1	1	19	1– 2	1.1	1	23	1– 2	1.7	2
Do	2	15	1– 2	1.9	2	20	1– 3	1.7	2	24	1– 3	1.5	1
Do	4	14	1– 2	1.6	2	20	3– 5	3.7	3	23	1– 3	1.9	1
Do	5	16	1– 1	1.0	1	20	1– 1	1.0	1	23	1– 1	1.0	1

TABLE 1.—*Pupal characters in the Anopheles leucosphyrus group*—Continued.

	Hairs.	*Anopheles leucosphyrus.*				*Anopheles leucosphyrus* var. *balabacensis.*				*Anopheles* near-*leucosphyrus.*			
		Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.
Abdominal segment VI (ventral)	D	4	1–1	1.0	1	7	2–2	2.0	2	8	1–2	1.8	2
Do	E	4	1–2	1.1	1	8	1–2	1.4	1	8	1–2	1.9	2
Do	6	3	1–2	1.8	2	8	1–2	1.4	1	7	1–3	2.0	2
Do	8	4	1–1	1.0	1	8	1–1	1.0	1	8	1–1	1.0	1
Do	9	4	1–1	1.0	1	8	1–1	1.0	1	8	1–1	1.0	1
Abdominal segment VII (dorsal)	A	Long, sometimes branched.				Long, branched.				Long, branched.			
Do	B	15	3–5	4.0	4	20	5–8	6.6	8	21	5–12	8.0	9
Do	C	16	1–2	1.0	1	19	1–3	1.8	2	19	1–3	2.0	2
Do	1	14	1–2	1.2	1	17	1–3	1.9	2	18	1–3	1.7	2
Do	2	16	1–2	1.7	2	20	1–2	1.6	2	24	1–2	1.4	1
Do	3	16	1–3	2.5	3	19	2–4	2.8	3	24	1–3	2.1	3
Do	4	16	2–3	2.3	2	19	3–5	3.9	4	23	1–3	2.0	2
Do	5	16	1–1	1.0	1	20	1–1	1.0	1	22	1–1	1.0	1
Abdominal segment VII (ventral)	D	4	1–1	1.0	1	8	1–2	1.5	2	8	1–3	1.9	2
Do	E	4	1–3	1.7	1	7	1–3	2.1	2	8	2–2	2.0	2
Do	6	3	2–2	2.0	2	8	1–3	2.0	2	8	2–4	3.0	4
Do	8	4	1–2	1.5	1	8	1–3	1.7	1	8	2–4	2.6	3
Do	9	4	1–1	1.0	1	8	1–1	1.0	1	8	1–1	1.0	1
Abdominal segment VIII (dorsal)	A	16	8–13	11.3	11	18	13–17	14.8	14	22	11–19	14.1	13
Do	A′	16	1–2	1.9	2	19	1–2	1.8	2	24	1–3	2.1	2
Do	5	16	1–1	1.0	1	20	1–1	1.0	1	23	1–6	1.8	2
Abdominal segment VIII (ventral)	9	4	1–1	1.0	1	8	1–1	1.0	1	8	1–1	1.0	1
Paddle	p	14	1–2	1.1	1	20	1–1	1.0	1	22	1–6	1.8	2
Do	ap	15	1–4	2.1	2	20	1–3	1.7	2	24	1–3	1.5	1
Do	Index	----	1.4–1.6	----	----	----	1.3–1.5	----	----	----	1.4–1.5	----	----

forms are in all planes like a brush. The denticles at the external border of the paddle extend farther down posteriorly, and are coarser in var. *balabacensis* than in near-*leucosphyrus*. *Anopheles leucosphyrus* and var. *balabacensis* are alike in the denticles and in the respiratory trumpets. The paddle hairs and accessory paddle hairs are of no differential value in the group, while the paddle indices (greatest length divided by the greatest width) vary within the same range in all the three forms.

Table 1 shows the variations in the different hairs of the pupæ.

THE ADULTS

Only the characters that have not been treated or have been only slightly discussed by Russell and Baisas [4] will be taken up here.

The buccopharyngeal armature (*Plate 15*).—In pattern the pharyngeal teeth vary among individuals within a species or variety. Those of var. *balabacensis* appear closest to that described and illustrated for *leucosphyrus* of other countries by Sinton and Covell (1927), Barraud and Covell (1928), and Christophers (1933). Var. *balabacensis*, however, has more teeth; the number varies from 10 to 12, whereas those for foreign *leucosphyrus* number only 8. The pharyngeal teeth of the local *leucosphyrus* and near-*leucosphyrus* number 8 each. But the pattern of the individual teeth in either species differs from that of foreign *leucosphyrus*. Moreover, the pattern for Luzon *leucosphyrus* differs from that for *leucosphyrus* found in Mindanao (Plate 15). Those of Luzon are generally more deeply indented by the larger divisions and have the apices somewhat spread; those of Mindanao have smaller divisions and taper toward the apices. The pharyngeal teeth of near-*leucosphyrus* are short and stout and are highly fimbriated at the apices. I do not have many specimens and therefore cannot make enough dissections to find out how constant the peculiarities are.

The wing.—It will be seen from Table 2 that certain indices of the wing veins and cells may be used to differentiate the members of the group. Text fig. 1 shows the parts of the wings used, and the relative lengths of the forked cells of the three species.

[4] The preceding article in this issue.

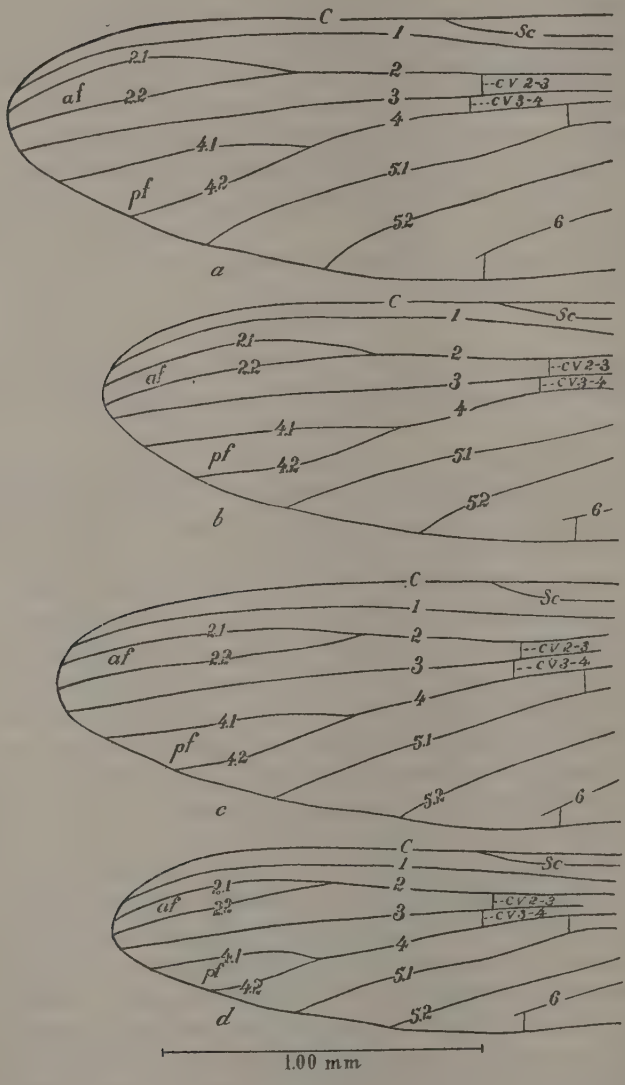

FIG. 1. Apical parts of wings from four species of *Anopheles*, showing relative lengths of forked cells and their respective petioles.

a, *Anopheles leucosphyrus*, from Luzon.

b, *Anopheles leucosphyrus*, from Mindanao.

c, *Anopheles leucosphyrus* var. *balabacensis*.

d, *Anopheles* near-*leucosphyrus*.

Note the positions of the bases of *pf* in relation to those of *af*; *C*, costa; *Sc*, subcosta; 1, 2, 3, 4, and 6, apical parts of longitudinal veins; 2.1 and 2.2, 4.1 and 4.2, and 5.1 and 5.2, forks of veins 2, 4, and 5, respectively; *cv* 2-3, crossvein between veins 2 and 3; *cv* 3-4, crossvein between veins 3 and 4.

TABLE 2.—*Measurements and indices of wing veins and forked cells in the Anopheles leucosphyrus group.*[a]

Species.	Sex.	Vein 2.2.				Petiole of 2.				Vein 4.2.				Petiole of 4.			
		Number examined.	Range of length.	Average length.	Commonest length.	Number examined.	Range of length.	Average length.	Commonest length.	Number examined.	Range of length.	Average length.	Commonest length.	Number examined.	Range of length.	Average length.	Commonest length.
Anopheles leucosphyrus	♂	20	34–43	37.9	38	20	42–63	51.5	51	20	20–30	24.1	23	20	24–30	26.3	26
Do	♀	37	39–58	46.4	46	37	46–61	54.0	50	37	25–38	31.5	30	37	24–31	27.4	27
Anopheles leucosphyrus var. *balabacensis.*	♂	16	37–50	44.4	44	16	42–60	50.2	50	16	21–31	26.7	25	16	24–32	28.5	28
Do	♀	16	45–58	51.9	52	16	41–58	50.2	50	16	25–37	30.5	30	16	26–35	29.9	28
Anopheles near-*leucosphyrus.*	♂	8	27–34	30.88	34	8	43–54	49.8	48	8	12–17	14.6	15	8	25–31	28.8	29
Do	♀	27	34–45	39.0	40	27	46–62	53.8	50	27	16–23	20.1	21	27	28–35	31.3	32

Species.	Sex.	Forked-cell index.				*Af*-petiole index.				*Pf*-petiole index.			
		Number examined.	Range of length.	Average length.	Commonest length.	Number examined.	Range of length.	Average length.	Commonest length.	Number examined.	Range of length.	Average length.	Commonest length.
Anopheles leucosphyrus	♂	20	1.38–1.74	1.57	1.58	20	1.21–1.61	1.36	1.25	20	0 97–1.29	1.09	1.00
Do	♀	37	1.23–1.96	1.47	1.40	37	0.94–1.37	1.17	1.11	37	0.70–1.07	0.87	0.90
Anopheles leucosphyrus var. *balabacensis.*	♂	16	1.54–1.85	1.77	1.76	16	1.12–1.31	1.25	1.20	16	0.93–1.33	1.07	1.12
Do	♀	16	1.56–1.88	1.71	1.84	16	0.86–1.07	0.97	0.97	16	0.70–1.18	0 99	0.90
Anopheles near-*leucosphyrus*	♂	8	1.87–2.26	2.11	2.00	8	1.47–1.77	1.61	1.60	8	1.67–2.33	1.97	1.90
Do	♀	27	1.70–2.13	1.94	1.90	27	1.10–1.70	1.38	1.38	27	1.34–1.88	1.56	1.52

[a] Veins 2.2 and 4.2 are measured from tips to points of bifurcation. Petiole of 2 from point of bifurcation to cv 2–3. Petiole of 4 from point of bifurcation to cv 3–4. Forked-cell index is 2.2 divided by 4.2. Petiole-forked-cell indices are petiole of 2 divided by 2.2 and petiole of 4 divided by 4.2. The measurements given above may be reduced to millimeters by dividing each figure by 60.

TABLE 3.—*Hairs and other characters of pupa of various species of Anopheles.*

	Designation of hairs.	*Anopheles gateri.*				*Anopheles gigas* var. *formosus.*				*Anopheles lindesayi* var. *benguetensis.*				*Anopheles karwari.*			
		Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.
Metathorax	R	16	2–4	2.9	3	10	2–4	2.3	2	16	2–5	3.7	4	20	1–4	3.0	3
Do	P	16	4–6	4.7	5	10	2–4	3.0	3	16	1–5	3.7	5	20	1–3	1.8	2
Do	O	14	3–5	3.6	3	10	1–4	2.2	2	16	1–3	2.0	2	20	1–3	1.6	2
Abdominal segment I	H	16	4–11	6.7	7	11	4–7	4.9	4	15	3–7	5.5	6	16	1–1	1.0	1
Do	K	16	2–5	3.6	3	11	2–4	2.9	3	16	1–2	1.1	1	16	3–5	4.2	4
Do	L	16	4–8	5.6	5	11	4–5	4.3	4	16	4–7	5.3	5	14	3–5	3.7	4
Do	M	16	2–5	3.0	3	10	1–3	1.5	2	15	2–2	2.0	2	14	2–5	3.6	4
Do	S	15	4–6	5.3	5	11	2–5	3.6	3	15	2–4	2.9	3	13	2–5	3.6	4
Do	T	16	2–5	3.2	3	11	2–3	2.3	2	14	1–1	1.0	1	15	2–3	2.7	3
Do	U	13	1–1	1.0	1	10	1–3	2.2	2	16	1–1	1.0	1	16	1–1	1.0	1
Abdominal segment II	A	Tiny, blunt				Tiny, blunt				Tiny, blunt				Tiny, blunt.			
Do	C	16	4–19	7.5	6	12	5–9	6.7	7	16	2–8	4.1	3	16	7–11	9.6	11
Do	1	16	2–4	2.7	3	12	2–4	2.9	2	15	1–1	1.0	1	10	2–4	2.9	3
Do	1	16	3–7	4.5	4	11	2–5	3.0	2	16	2–6	3.4	3	10	2–4	3.2	4
Do	2	15	2–4	3.0	3	12	2–5	4.0	4	16	2–5	2.8	3	10	2–5	3.2	3
Do	2	15	3–5	3.9	4	12	1–4	3.0	3	16	3–7	4.3	3	9	3–6	4.8	5
Do	3	16	3–5	4.3	5	12	1–2	1.8	2	16	1–2	1.9	2	12	1–1	1.0	1
Do	4	16	9–13	10.7	10	12	6–8	7.1	8	16	2–4	3.0	3	10	4–6	4.9	5
Do	5	15	1–3	1.2	1	12	1–1	1.0	1	13	1–1	1.0	1	7	1–2	1.1	1
Abdominal segment III (dorsal)	A	Short, blunt				Short, blunt				Short, blunt				Short, blunt.			
Do	B	16	10–14	11.1	12	12	7–11	8.5	8	15	5–9	6.2	6	15	4–7	5.3	5
Do	C	16	7–16	12.1	11	12	5–7	6.2	7	16	5–11	7.4	8	15	3–8	5.2	5
Do	1	16	2–6	3.4	3	12	2–5	3.4	3	16	1–2	1.3	1	13	3–3	3.0	3
Do	2	14	2–5	3.2	3	11	2–4	2.3	3	16	2–7	4.5	6	10	4–6	4.6	4
Do	3	16	5–10	5.8	6	12	1–2	1.3	1	16	1–5	2.3	2	9	1–4	2.0	2
Do	4	16	9–15	12.5	12	12	5–6	5.4	5	16	1–5	2.9	3	9	3–5	4.1	4
Do	5	15	1–2	1.2	1	10	1–3	1.3	1	16	1–1	1.0	1	9	1–1	1.0	1

Abdominal segment III (ventral)	E	12	1– 4	3.1	3	8	2– 3	2.1	2	12	2– 3	2.4	2				
Do	6	12	3– 4	3.7	4	8	3– 4	3.0	3	12	2– 4	2.6	3				
Do	7	12	3– 4	3.3	3	8	3– 6	3.9	3	12	2– 5	3.5	4				
Do	8	12	2– 4	3.5	4	8	1– 2	1.0	1	12	1– 1	1.0	1				
Do	9					8	1– 1	1.0	1								
Abdominal segment IV (dorsal)	A	Short blunt.				Pointed				Pointed				Tiny, blunt.			
Do	B	16	5–13	9.0	12	10	7–10	7.8	7	16	5–12	8.3	8	18	3– 5	3.3	3
Do	C	16	5–11	9.4	10	11	5– 6	5.2	5	16	2–12	6.6	6	16	2– 5	3.0	3
Do	1	16	1– 3	2.1	2	12	2– 3	2.3	2	16	1– 1	1.0	1	17	1– 2	1.1	1
Do	2	16	2– 4	2.9	3	12	2– 3	2.6	2	16	2– 6	3.9	3	17	2– 5	3.9	4
Do	3	16	6–11	7.4	8	12	3– 5	4.1	4	16	1– 7	3.4	4	16	3– 5	4.1	4
Do	4	16	11–14	11.5	11	12	2– 4	3.0	3	15	1– 3	2.1	2	17	1– 2	1.3	1
Do	5	7	1– 1	1.0	1	12	1– 3	1.6	1	16	1– 1	1.0	1	17	1– 2	1.1	1
Abdominal segment IV (ventral)	E	12	2– 4	2.3	2	8	1– 2	1.3	1	12	1– 1	1.0	1				
Do	6	12	2– 5	3.3	3	8	2– 3	2.8	3	12	2– 4	2.9	3				
Do	7	12	2– 4	2.8	3	8	1– 4	3.4	4	11	2– 6	3.7	4				
Do	8	12	2– 4	2.8	3	8	1– 1	1.0	1	12	1– 1	1.0	1				
Do	9					8	1– 1	1.0	1	12	1– 1	1.0	1				
Abdominal segment V (dorsal)	A	Short blunt.				Pointed				Long, pointed.				Long, pointed.			
Do	B	16	4– 8	6.1	6	12	5– 7	6.0	6	16	11–18	13.1	12	16	1– 3	1.7	2
Do	C	16	2– 4	2.8	3	12	2– 4	3.5	4	16	2– 8	4.9	5	14	1– 1	1.0	1
Do	1	15	1– 2	1.6	2	11	1– 2	1.9	2	16	1– 1	1.0	1	18	1– 3	1.3	1
Do	2	16	2– 4	2.9	3	12	2– 3	2.6	3	16	2– 4	3.1	3	17	1– 3	2.2	2
Do	3	16	2– 4	2.9	3	12	1– 2	1.5	2	16	1– 4	2.2	2	17	1– 3	2.1	2
Do	4	15	10–16	11.8	11	12	2– 4	3.1	3	16	1– 2	1.4	1	17	1– 2	1.2	1
Do	5	7	1– 1	1.0	1	12	1– 3	1.3	1	14	1– 1	1.0	1	16	1– 1	1.0	1
Abdominal segment V (ventral)	D	12	2– 3	2.6	3	8	2– 3	2.9	3	12	2– 3	2.5	3				
Do	E	12	2– 3	2.3	2	8	1– 1	1.0	1	12	1– 2	1.2	1				
Do	6	12	3– 5	3.4	3	8	2– 3	2.5	3	12	2– 4	3.0	3				
Do	8	12	1– 3	1.6	1	8	1– 2	1.0	1	12	1– 1	1.0	1				
Do	9	12	1– 1	1.0	1	8	1– 2	1.1	1	12	1– 1	1.0	1				

TABLE 3.—*Hairs and other characters of pupa of various species of Anopheles*—Continued.

	Designation of hairs.	*Anopheles gateri.*				*Anopheles gigas* var. *formosus.*				*Anopheles lindsayi* var. *benguetensis.*				*Anopheles karwari.*			
		Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.	Number examined.	Range of branches.	Average branches.	Commonest branches.
Abdominal segment VI (dorsal)	A	Short, blunt				Long, pointed				Long, pointed				Long, pointed.			
Do	B	16	3–6	4.8	5	12	4–11	6.3	6	16	8–19	12.8	12	16	1–2	1.3	1
Do	C	16	1–3	2.3	2	12	2–4	2.5	2	16	2–5	3.3	2	17	1–1	1.0	1
Do	C′	16	1–2	1.4	1	12	1–2	1.0	1	16	1–3	2.3	3	17	1–3	2.0	2
Do	1	16	1–2	1.5	1	12	1–2	1.2	1	16	1–1	1.0	1	18	1–3	1.4	1
Do	2	16	1–3	2.0	2	12	1–1	1.0	1	16	1–2	1.7	2	17	1–2	1.3	1
Do	4	14	6–12	9.3	9	12	3–4	3.1	3	16	1–2	1.0	1	17	1–2	1.1	1
Do	5	11	1–1	1.0	1	12	1–2	1.0	1	16	1–1	1.0	1	14	1–1	1.0	1
Abdominal segment VI (ventral)	D	12	1–2	1.4	1	8	1–2	1.0	1	12	1–2	1.2	1				
Do	E	10	2–4	3.1	3	8	1–2	1.2	1	12	1–3	2.1	2				
Do	6	12	2–5	3.3	3	8	1–3	1.9	2	12	2–4	3.2	3				
Do	8	12	1–2	1.2	1	8	1–1	1.0	1	12	1–2	1.0	1				
Do	9	12	1–1	1.0	1	8	1–1	1.0	1	12	1–2	1.1	1				
Abdominal segment VII (dorsal)	A	Stout, blunt				Long, pointed				Very long, pointed				Long, pointed.			
Do	B	16	3–7	4.8	5	12	4–8	6.6	8	15	9–16	11.1	11	18	1–2	1.3	1
Do	C	16	1–2	1.3	1	12	1–3	1.8	2	16	1–8	3.1	2	20	1–2	1.1	1
Do	1	16	2–6	4.0	4	12	3–4	2.8	3	16	1–2	1.6	2	20	1–3	1.1	1
Do	2	16	2–3	2.2	2	12	1–1	1.0	1	16	1–3	2.0	2	19	1–2	1.3	1
Do	3	15	4–7	5.0	5	12	1–3	1.7	2	16	1–3	3.3	3	20	1–3	1.9	2
Do	4	16	4–11	6.3	6	12	2–4	2.9	3	16	1–2	1.9	2	20	1–2	1.4	1
Do	5	16	1–3	1.1	1	12	1–1	1.0	1	12	1–1	1.0	1	17	1–1	1.0	1
Abdominal segment VII (ventral)	D	12	1–3	1.8	2	8	1–2	1.0	1	12	1–2	1.3	1				
Do	E	12	2–5	3.6	4	8	1–3	1.5	2	12	1–3	1.8	2				
Do	6	12	5–10	7.3	7	8	1–3	1.5	1	12	2–3	2.9	3				
Do	8	12	2–4	2.3	2	8	1–2	1.2	1	12	1–3	1.8	2				
Do	9	12	1–1	1.0	1	8	1–1	1.0	1	12	1–1	1.0	1				

Abdominal segment VIII (dorsal)	A	9	12–20	15.9	15	11	9–17	12.9	11	16	13–20	16.4	17	20	7–16	10.7	12
Do	A'	16	3– 4	3.0	8	12	1– 2	1.0	1	16	1– 2	1.7	2	18	1– 3	1.4	1
Do		5	13	1– 1	1.0	1	12	1– 1	1.0	1	16	1– 1	1.0	1	19	1– 1	1.0	1
Abdominal segment VII (ventral)		9	16	1– 1	1.0	1	12	1– 1	1.0	1	16	1– 1	1.0	1				
Paddle		p	15	5–12	8.3	8	12	1– 1	1.0	1	Simple, long, hooked.				Simple, long, hooked.			
Do		sp	16	3– 6	4.1	4	Short, simple				16	2– 2	2.0	2	20	1– 3	2.1	2
Denticles			Fairly coarse				Fine				None				Rudimentary.			
Hairs			Cover posterior half				Short, tiny				Long, numerous, cover posterior two-thirds.				Fairly long.			
Index			1.25–1.30				1.35–1.40				1.80–1.90				1.45–1.55			

SUMMARY AND CONCLUSIONS

1. Additional characters that will help in the differential diagnosis of the members of the *Anopheles leucosphyrus* group are presented.

2. *Anopheles* near-*leucosphyrus* is considered to be a distinct species, and should, therefore, be given a definite name. I leave this to Dr. W. V. King, who has the first specimens of this species.

3. The form found in Palawan and Balabac is assigned to varietal rank, for which the name *A. leucosphyrus* var. *balabacensis* is proposed.

4. The form found in Luzon and Mindanao, despite minor differences, is considered identical with *A. leucosphyrus* Dönitz (1901).

OTHER SPECIES

ANOPHELES GATERI sp. nov.

Type specimens.—Male (lot R65–38) and female (lot R65–6) and their corresponding larval skins, together with some cotypes, are in the collections of the Bureau of Health, Manila.

Type locality.—Iwahig, Palawan.

Collector.—Mr. Andres Nono.

Date of collection.—June, 1934.

This species was given the provisional designation of *A. baezai* var. (?) in the papers of Russell and Baisas (1934–1936). The definite name, *A. gateri*, which I propose, is necessary for the convenience of Philippine workers.

Originally found in the larval stage by Dr. C. Manalang, in Zamboanga, Mindanao, *A. gateri* has subsequently been reported from various places in the Philippines. It was found in northern Mindanao by Mr. D. Santiago; in a number of the Visayan Islands by Dr. P. F. Russell and Mr. Andres Nono; in Culion and Iwahig by Mr. A. Nono; and in Balabac Island by Mr. F. Guinto. The northern limit of its distribution seems to be Camarines Norte, Luzon, where it was encountered by Dr. E. Celis, of the Bureau of Health, in 1933, and subsequently, 1934, by Mr. D. Santiago. It has not been met with farther north. It seems to be widely distributed southward and east and west in the Archipelago.

The first adult secured of this species was a male, which emerged from one of the larvæ collected in the small island of Cagayan between Palawan and Negros, by Dr. P. F. Russell

and Mr. Andres Nono. This specimen is also in the Bureau of Health collection.

The larva.—A description of the larva is given in the practical illustrated key to larvæ of Philippine anopheles mentioned above.

The pupa.—The characters of the pupa are presented in Table 3. Plates 3 and 4 show the principal parts. Note the respiratory trumpet.

The adult.—Imaginal characters are given by Russell and Baisas in the article preceding this one. The buccopharyngeal armature carries no teeth.

In Table 3 are also included the pupal characters of *Anopheles gigas* var. *formosus*, *A. lindesayi* var. *benguetensis*, and *A. karwari*.[5] Some of the plates illustrate parts of these species. The illustrations and descriptions may be compared with those given by Senevet (1930, 1931, and 1932).

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[5] Pupal mounts of *karwari* have been lent me by Mr. Domingo Santiago to whom I am much indebted in many ways.

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ILLUSTRATIONS

[All the illustrations were drawn with the aid of a camera lucida. The respiratory trumpets were drawn without cover glass; the other parts were drawn from flat preparations. The following designations of hairs and other characters apply to all the plates of the same parts.]

PLATE 1. ANOPHELES GIGAS VAR. FORMOSUS LUDLOW

Left half, dorsal side, of some pupal segments, showing—

Metathorax. Hairs *R*, *P*, and *O*.

Abdominal segment I. Hairs *H*, *K*, *L*, *M*, *S*, *T*, and *U*; *t* is the base of the dendritic tuft.

Abdominal segment II. *A*, Spine; *C*, large dorsal hair in most species, but not so large in *formosus;* 1-1, 2-2, 3, 4, and 5, other dorsal hairs.

Abdominal segment III. *A*, Spine; *B*, and *C*, large dorsal hairs; 1, 2, 3, 4, and 5, other dorsal hairs.

Abdominal segment VI. *A*, Spine; *B*, *C*, and *C'*, large dorsal hairs; 1, 2, 4, and 5, other dorsal hairs.

PLATE 2. ANOPHELES GIGAS VAR. FORMOSUS LUDLOW

FIG. 1. Respiratory trumpet, top view.

2. Respiratory trumpet, side view.

3. Paddle, showing *e*, external border of paddle with denticles and hairs; *p*, paddle hair; *ap*, accessory paddle hair. Part of segment VIII is also shown, *A*, spine; *A'*, accessory hair of spine; 5, dorsal hair.

PLATE 3. ANOPHELES GATERI SP. NOV.

PLATE 4. ANOPHELES GATERI SP. NOV.

FIG. 1. Respiratory trumpet.

2. Paddle and part of segment VIII.

PLATE 5. ANOPHELES LINDESAYI VAR. BENGUETENSIS KING

PLATE 6. ANOPHELES LINDESAYI VAR. BENGUETENSIS KING

FIG. 1. Respiratory trumpet.

2. Paddle and part of segment VIII.

PLATE 7. ANOPHELES KARWARI JAMES

PLATE 8. ANOPHELES KARWARI JAMES

FIG. 1. Respiratory trumpet.

2. Paddle and part of segment VIII.

PLATE 9. ANOPHELES LEUCOSPHYRUS DÖNITZ

PLATE 10. ANOPHELES LEUCOSPHYRUS DÖNITZ

FIG. 1. Respiratory trumpet.
2. Paddle and part of segment VIII.

PLATE 11. ANOPHELES LEUCOSPHYRUS VAR. BALABACENSIS VAR. NOV.

PLATE 12. ANOPHELES LEUCOSPHYRUS VAR. BALABACENSIS VAR. NOV.

FIG. 1. Respiratory trumpet.
2. Paddle and part of segment VIII.

PLATE 13. ANOPHELES NEAR-LEUCOSPHYRUS KING

PLATE 14. ANOPHELES NEAR-LEUCOSPHYRUS KING

FIG. 1. Respiratory trumpet.
2. Paddle and part of segment VIII.

PLATE 15. BUCCOPHARYNGEAL TEETH

FIG. 1. *Anopheles leucosphyrus*, from Luzon; teeth 3 to 8.
2. *Anopheles leucosphyrus* var. *balabacensis* var. nov., teeth 6 to 12.
3. *Anopheles* near-*leucosphyrus*, teeth 4 to 8.
4. *Anopheles leucosphyrus* var. *balabacensis* var. nov., teeth, whole set.
5. *Anopheles leucosphyrus*, from Mindanao; teeth 4 to 8.
6. *Anopheles* near-*leucosphyrus*, teeth 5 to 8.

TEXT FIGURE

FIG. 1. Apical parts of wings from three species of *Anopheles*, showing relative lengths of forked cells and their respective petioles.
a, *Anopheles leucosphyrus*, from Luzon.
b, *Anopheles leucosphyrus*, from Mindanao.
c, *Anopheles leucosphyrus* var. *balabacensis*.
d, *Anopheles* near-*leucosphyrus*.
Note the positions of the bases of *pf* in relation to those of *af*; *C*, costa; *Sc*, subcosta; 1, 2, 3, 4, and 6, apical parts of longitudinal veins; 2.1 and 2.2, 4.1 and 4.2, and 5.1 and 5.2, forks of veins 2, 4, and 5, respectively; *cv* 2-3, crossvein between veins 2 and 3; *cv* 3-4, crossvein between veins 3 and 4.

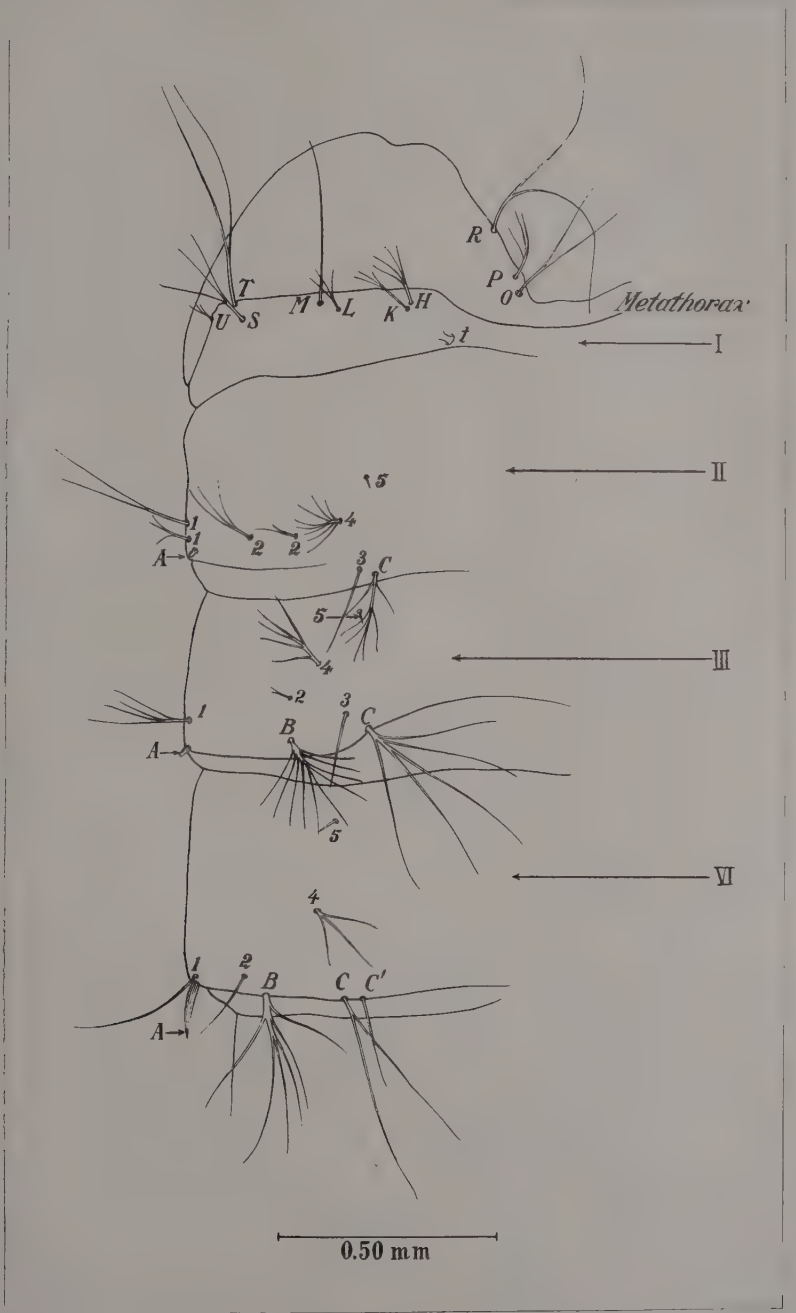

PLATE 1. ANOPHELES GIGAS VAR. FORMOSUS.

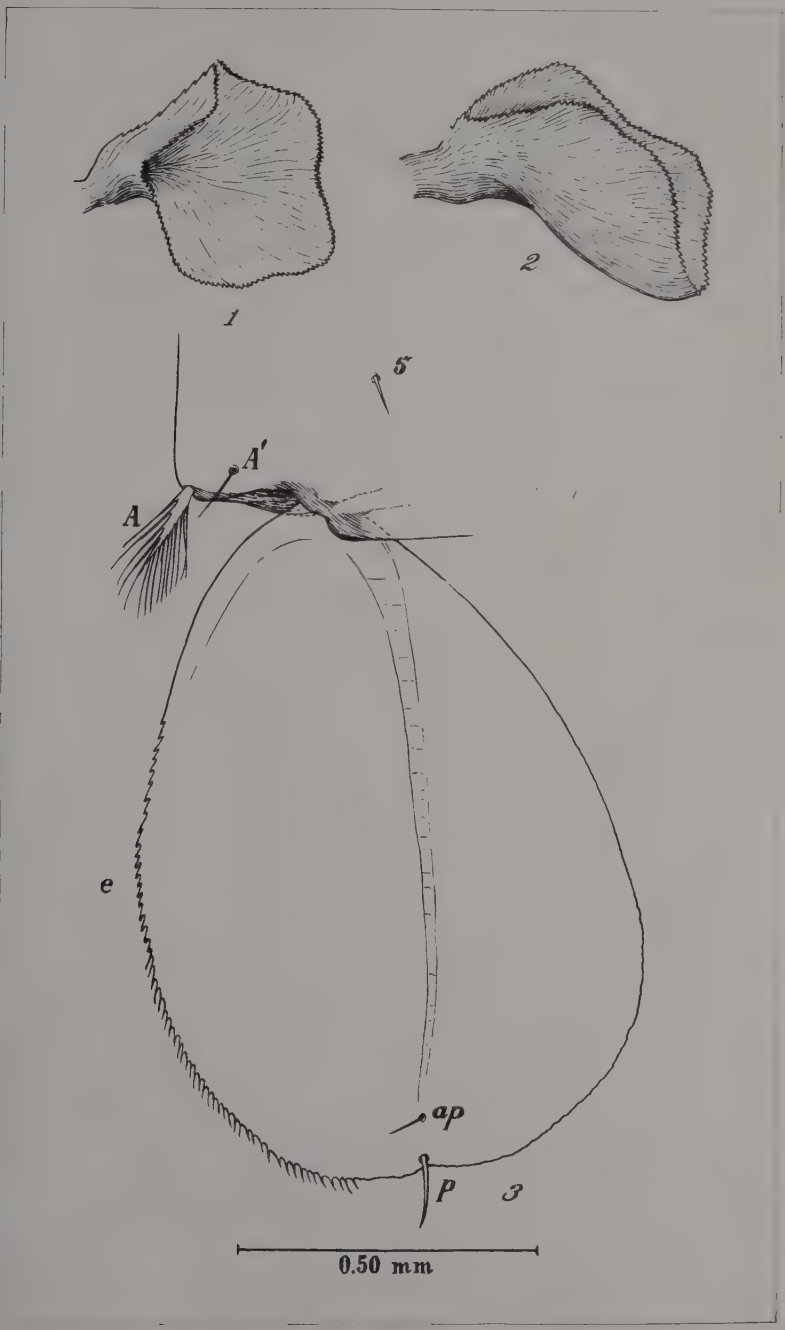

PLATE 2. ANOPHELES GIGAS VAR. FORMOSUS.

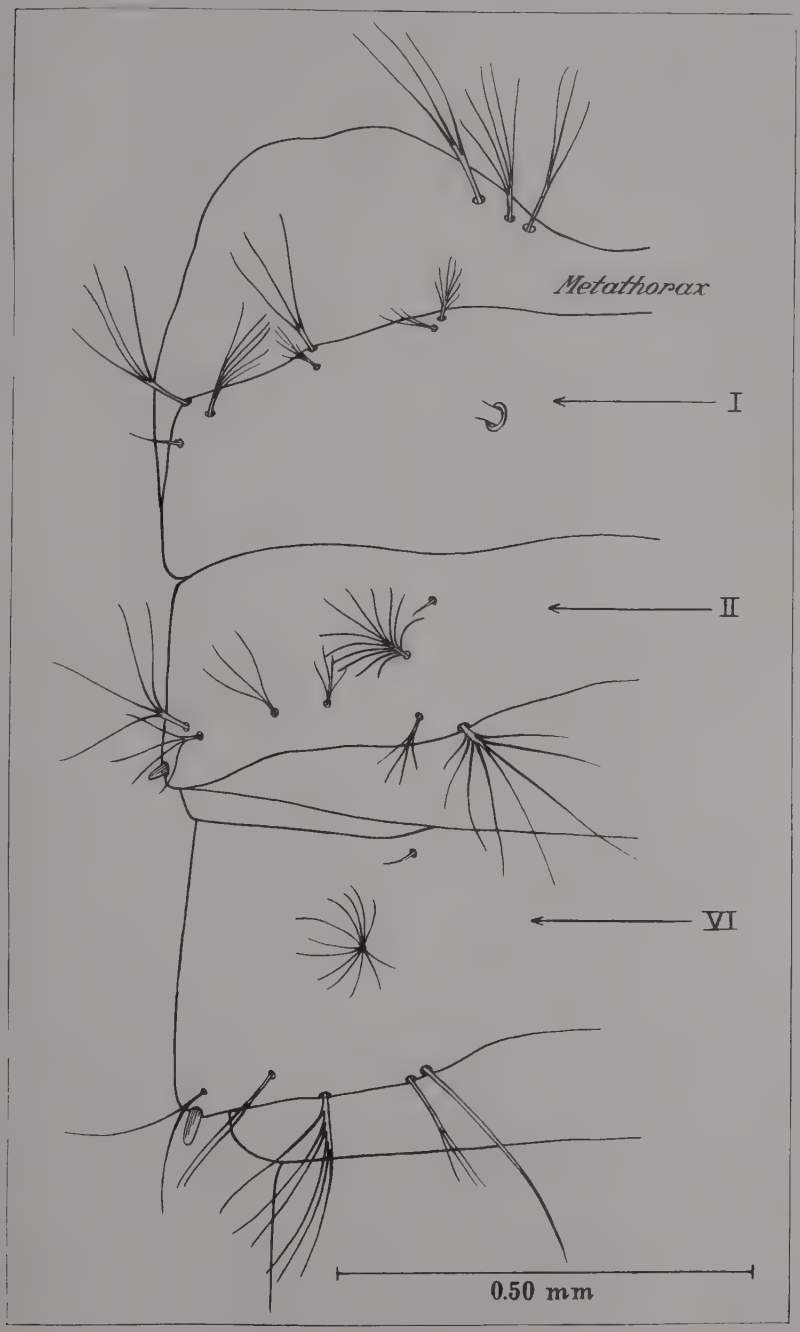

PLATE 3. ANOPHELES GATERI.

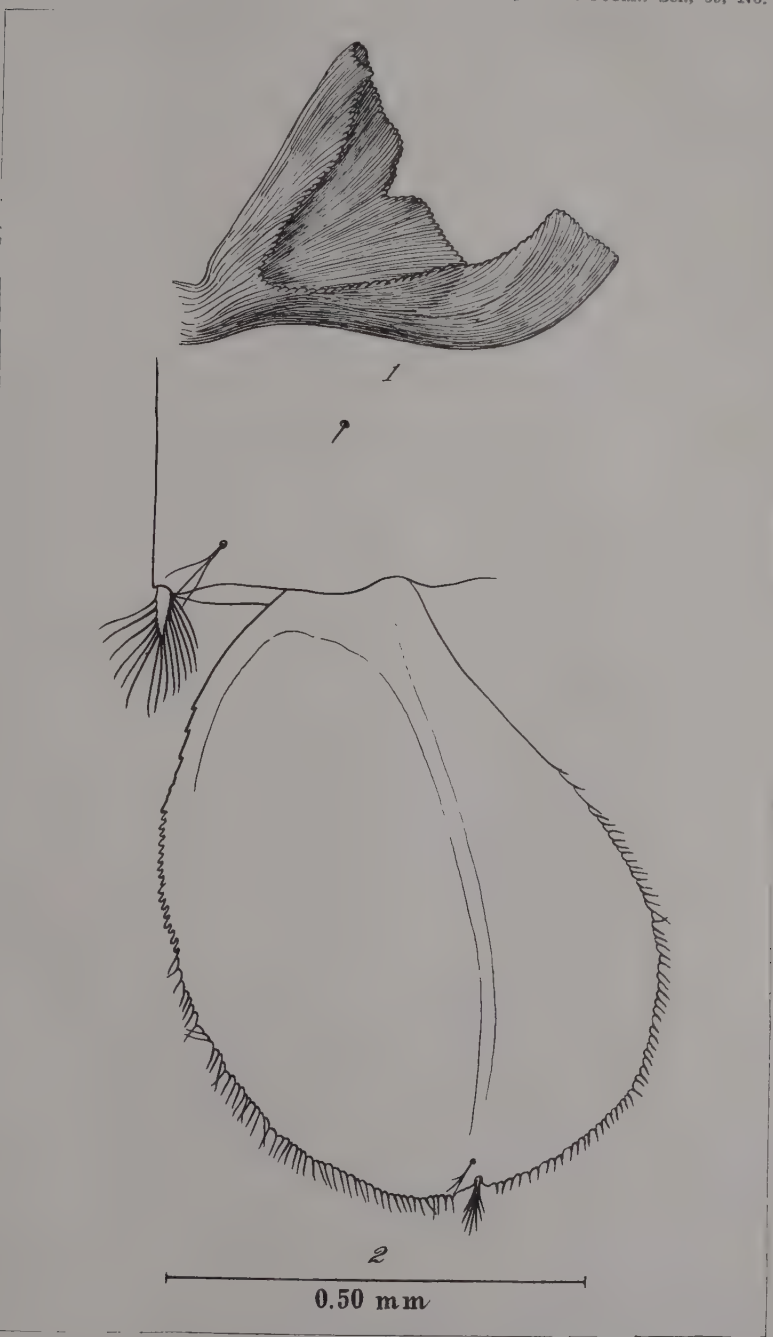

PLATE 4. ANOPHELES GATERI.

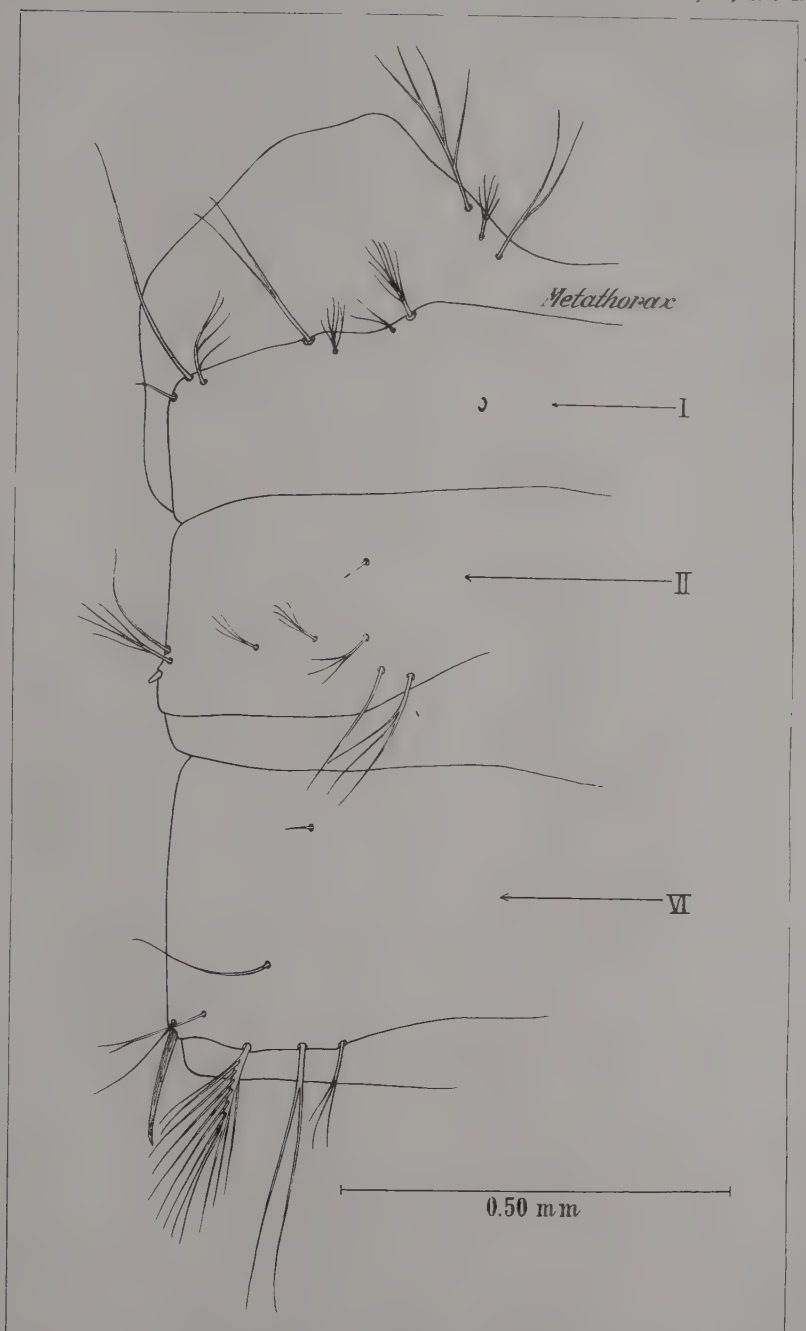

PLATE 5. ANOPHELES LINDESAYI VAR. BENGUETENSIS.

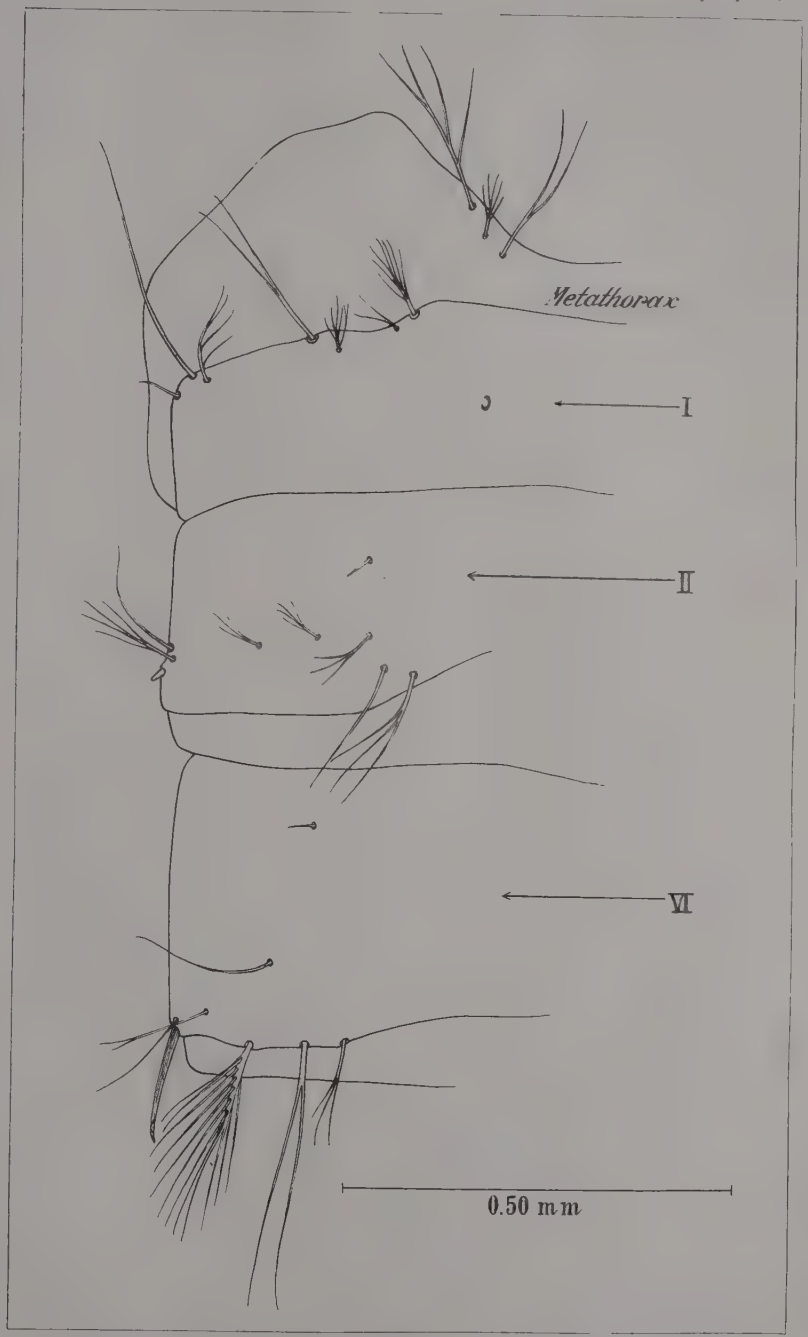

PLATE 5. ANOPHELES LINDESAYI VAR. BENGUETENSIS.

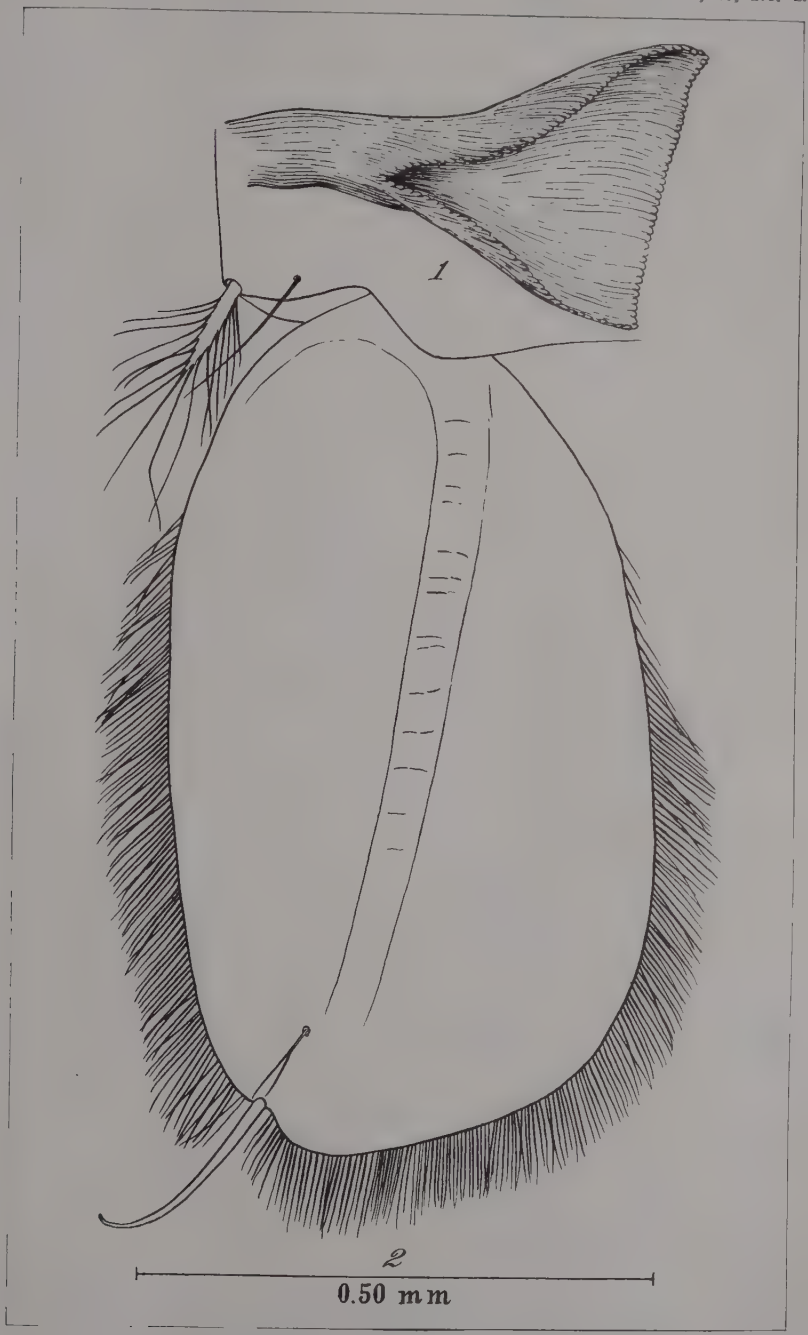

PLATE 6. ANOPHELES LINDESAYI VAR. BENGUETENSIS.

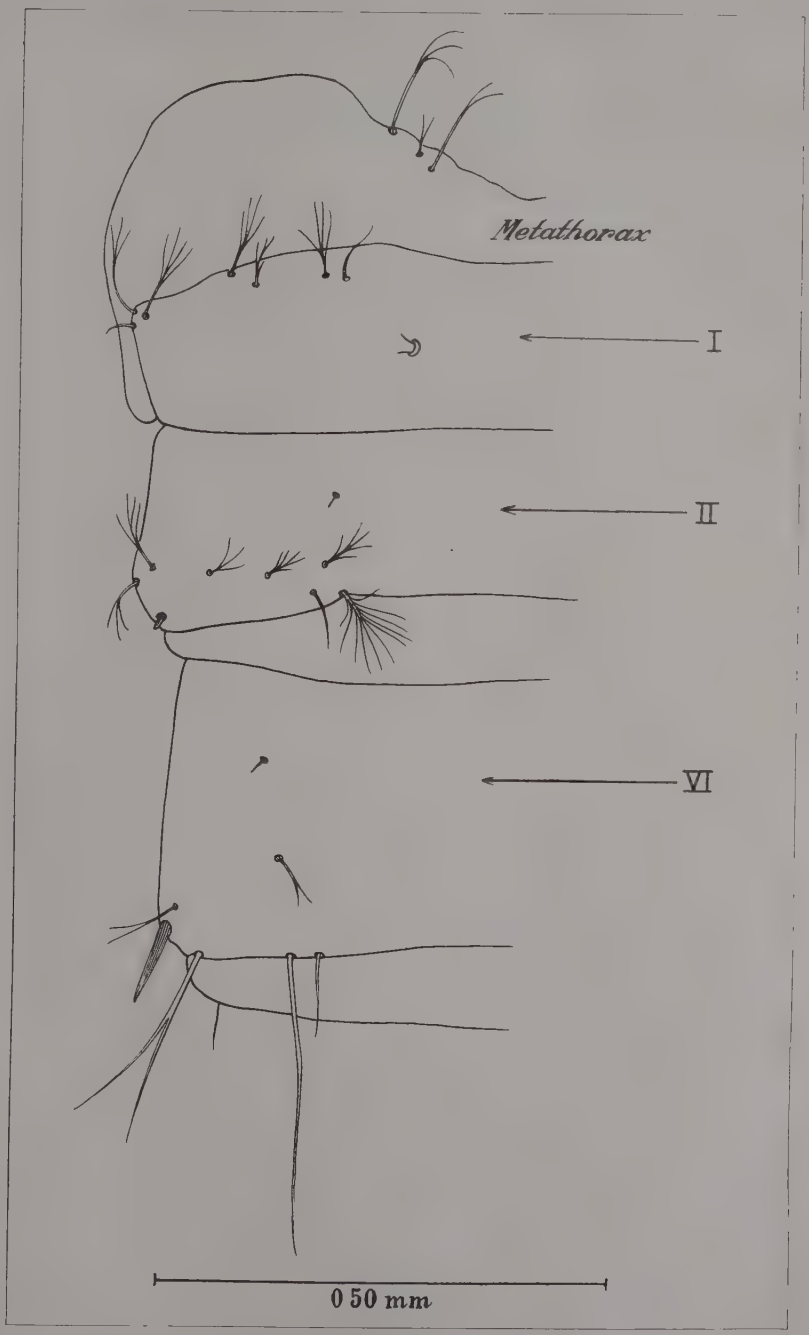

PLATE 7. ANOPHELES KARWARI.

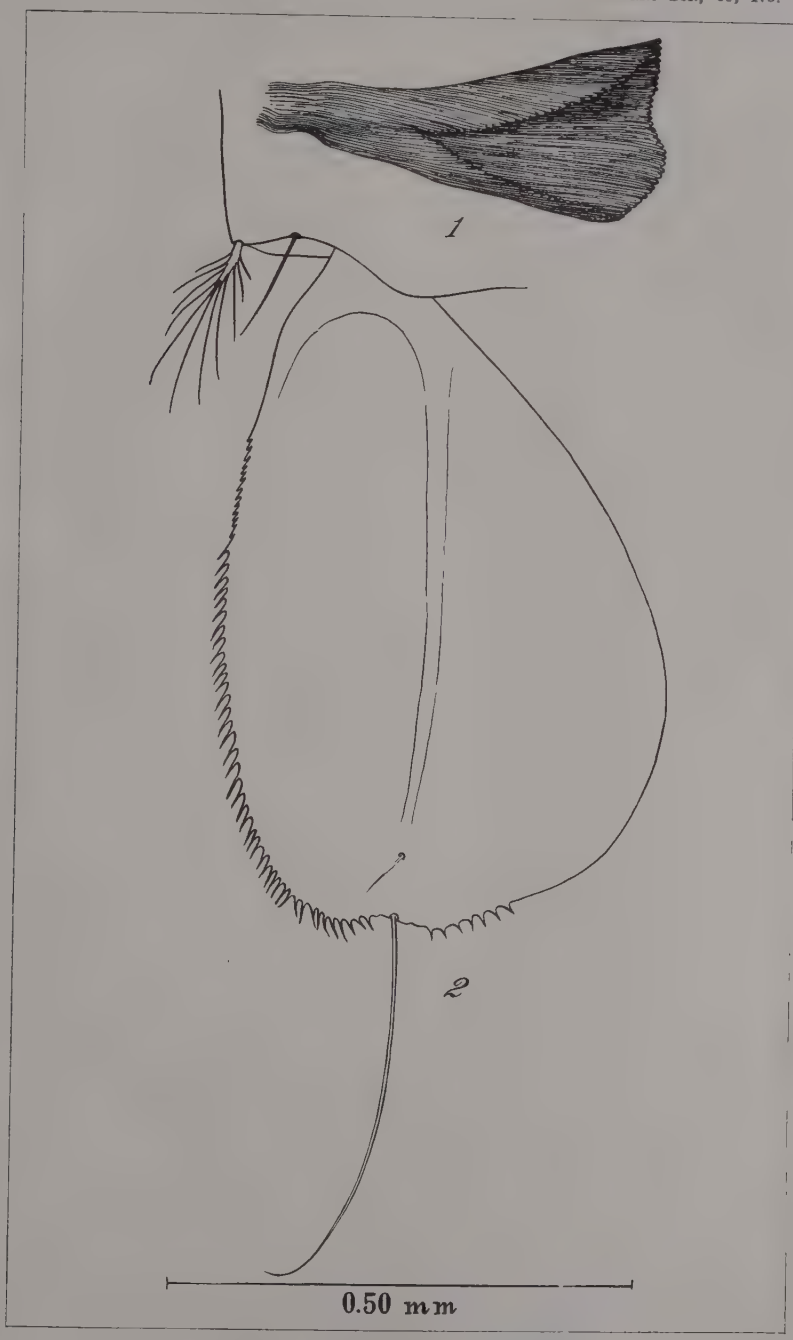

PLATE 8. ANOPHELES KARWARI.

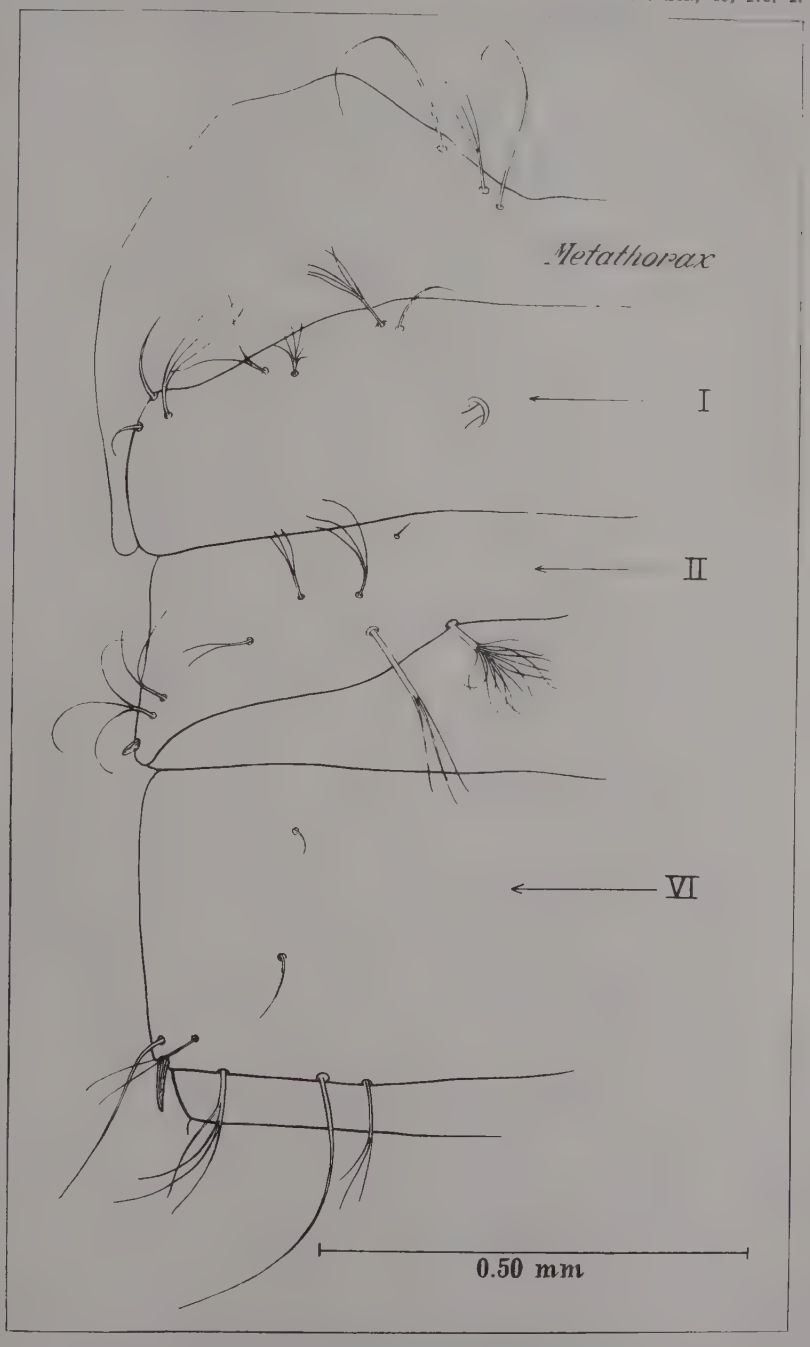

PLATE 9. ANOPHELES LEUCOSPHYRUS.

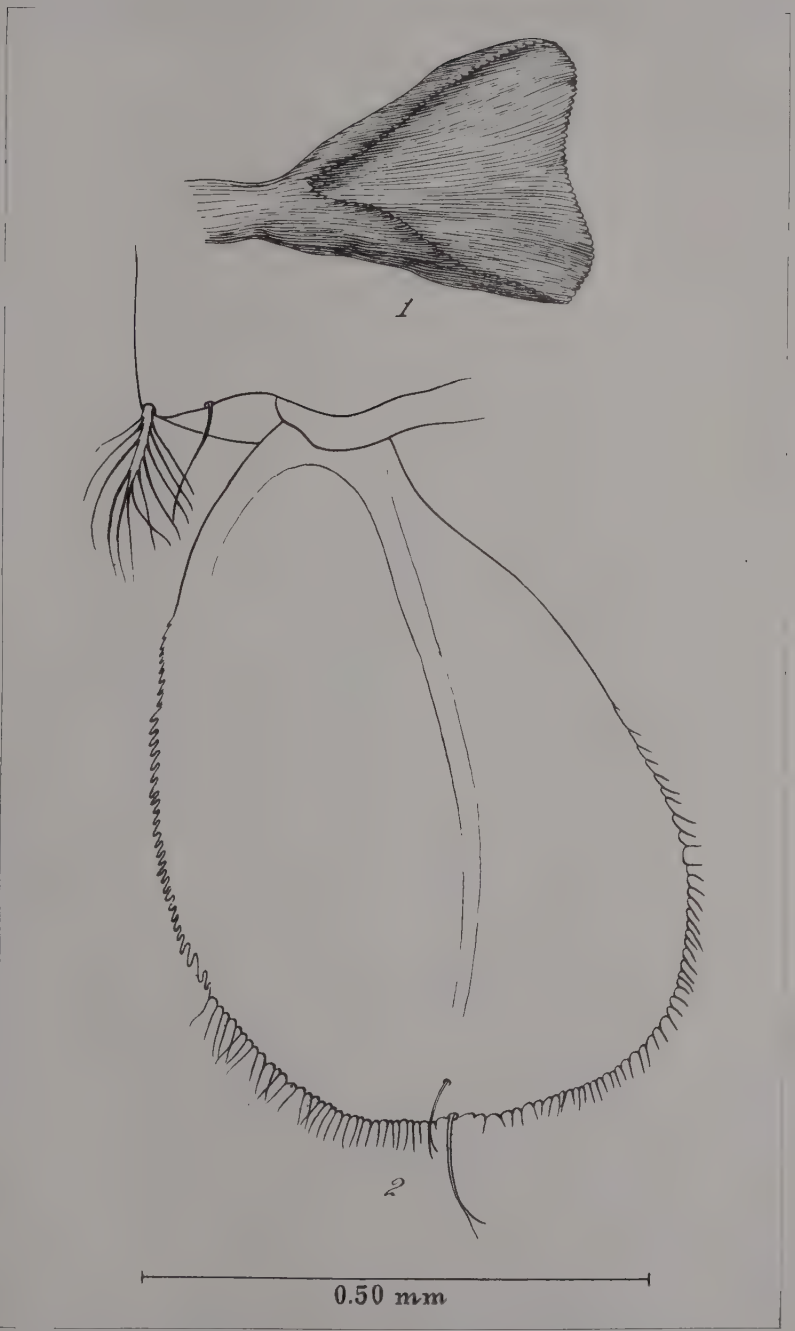

PLATE 10. ANOPHELES LEUCOSPHYRUS.

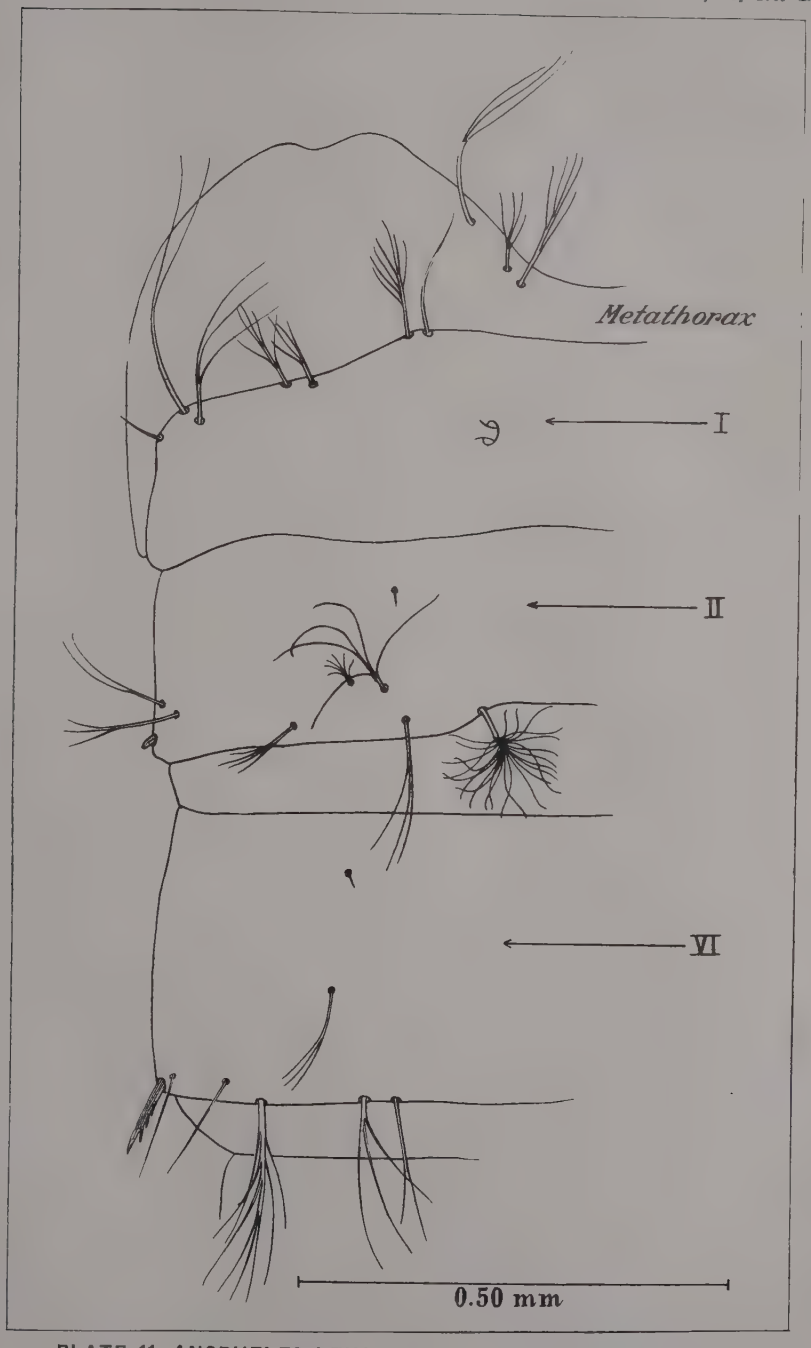

PLATE 11. ANOPHELES LEUCOSPHYRUS VAR. BALABACENSIS.

PLATE 12. ANOPHELES LEUCOSPHYRUS VAR. BALABACENSIS.

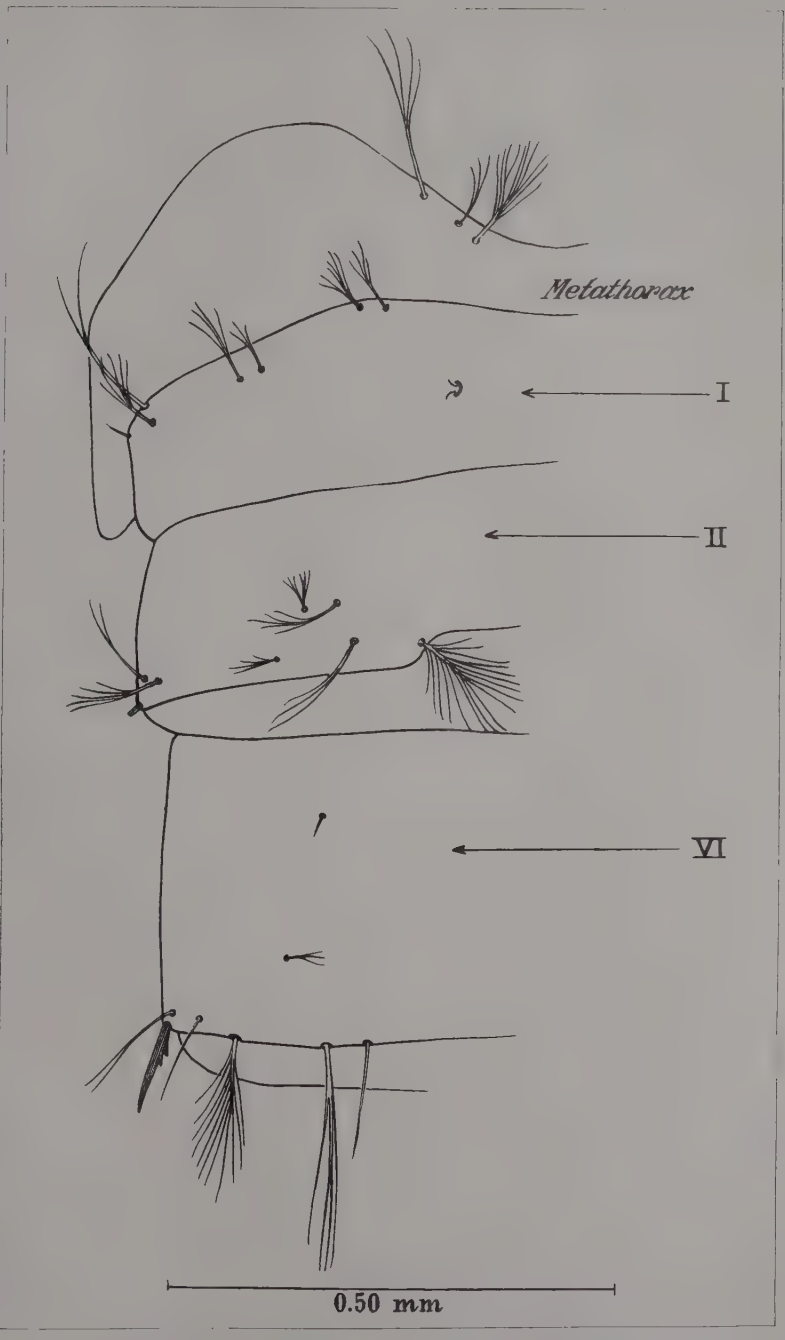

PLATE 13. ANOPHELES NEAR-LEUCOSPHYRUS.

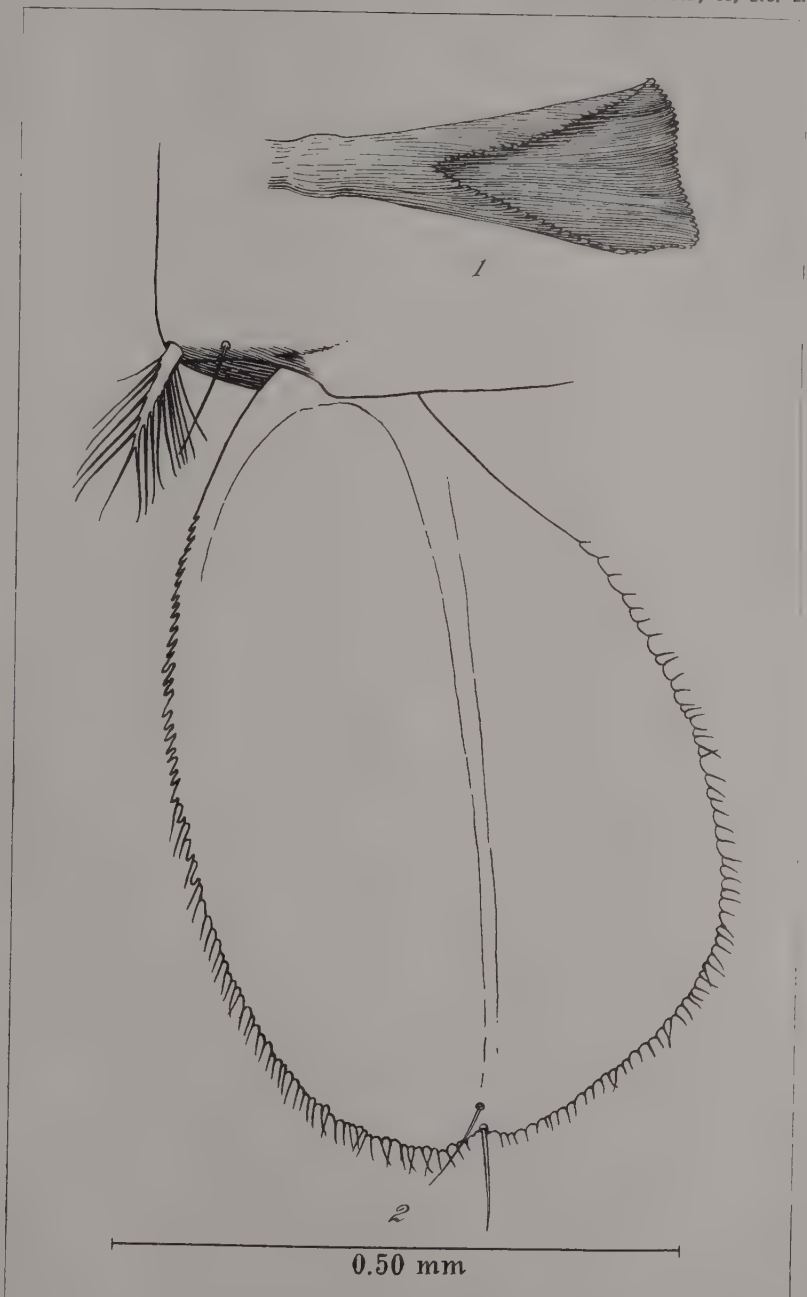

PLATE 14. ANOPHELES NEAR-LEUCOSPHYRUS

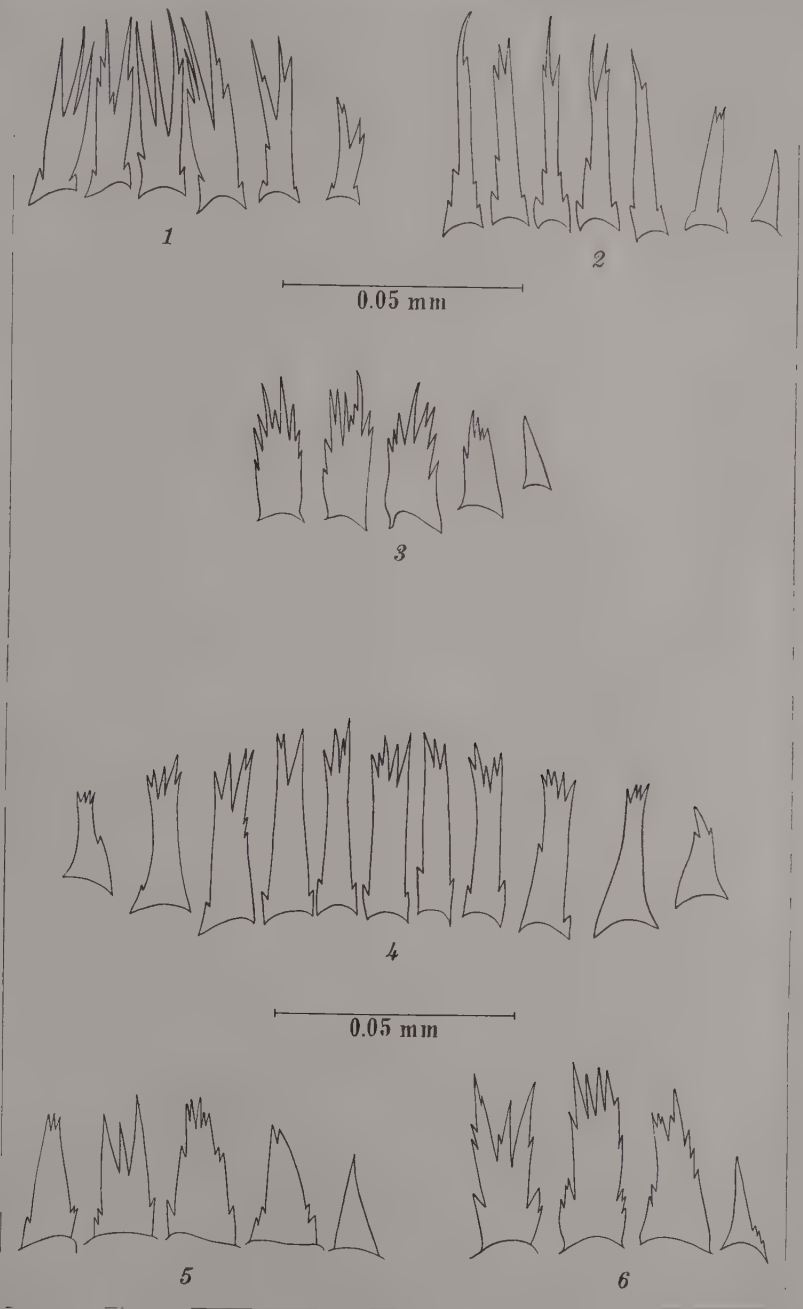

PLATE 15.

THE AMERICAN SPECIES OF PSYCHODA (DIPTERA: PSYCHODIDÆ)[1]

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SIX PLATES AND ONE TEXT FIGURE

INTRODUCTION

The family Psychodidæ has recently been the subject of great attention, especially the members of the blood-sucking genus *Phlebotomus*, but hitherto comparatively little has been published on the nonblood-sucking forms of the genus *Psychoda* Latreille.

Psychoda includes the flies popularly known as "moth flies" because of the peculiar rooflike position of the wings when the adults are at rest, which gives them the appearance of tiny moths. This group of insects (also known as "owl midges") includes the commonest species of flies that breed in the bacterial film of the sprinkling filter beds used for the purification of sewage. These flies are usually found about water-logged ditches, along creeks filled with decaying vegetable and organic matter, along small streams where water trickles, near piles of decaying leaves, and in similar places.

Some reference has already been made to the medical importance of several species. Headlee and Beckwith (1918) have called attention to two species, *Psychoda alternata* Say and *Ps. phalænoides* Linnæus, which breed in such numbers in sprinkling filter beds as to be a nuisance in human habitations around or near the plant by entering the buildings and getting into food. The persons concerned believe that these flies are the carriers of infections from which the inhabitants suffer. The

[1] Thesis presented to the faculty of the School of Hygiene and Public Health of the Johns Hopkins University, Baltimore, in partial fulfillment of the requirements for the degree of Doctor of Science in Hygiene (Medical Entomology), October, 1934. The writer was a fellow of the International Health Division of the Rockefeller Foundation from September 15, 1932, to October 15, 1934; it is a pleasure to acknowledge his indebtedness to this institution. Read before the Third Philippine Science Convention, held in Manila, February 28, 1935.

same authors stated that the flies, emerging from the overwintering pupæ and larvæ, occurred in such numbers that for a period it was almost impossible to work at the filter without getting some of them in the nose and mouth. In England a similar situation was reported by Kershaw (cited by Riley and Johannsen, 1932) with the same species, *Ps. alternata* and *Ps. phalænoides*. He pointed out that these species occur in such vast numbers as to be a nuisance to the vicinity, sticking to clothes, food, and lamps, and in some cases making breathing without swallowing them a difficult matter. If these species should prove capable of transmitting intestinal infections present in sewage material, they can be of considerable danger to the community. Although vague statements have been made as to danger from these flies, no adequate evidence has been presented.

Patton and Evans (1929) described a case of myiasis in a 3-year old boy due to the larvæ of *Ps. albipennis*. Invasion was suggested through ingestion of soil containing the larvæ; the larvæ probably migrated from the rectum to the bladder. Okada (1927) reported a case of gastric myiasis in a girl of 17 years caused by the ingestion of *Ps. b-punctata* Curtis.

Turner in 1923 demonstrated the feasibility of using *Ps. alternata* and *Ps. minuta* Banks as laboratory animals or as subjects for studies in heredity. Their short life cycle and great productivity and the ease with which they can be bred in natural media are chiefly responsible for making them ideal for breeding experiments.

In view of these facts, a systematic review of the genus is presented in this paper. The present status of these flies is systematically described so as to facilitate the determination of specimens.

This paper is based mainly upon the collections of the United States National Museum. The Museum of Comparative Zoölogy at Cambridge, the Cornell University collections at Ithaca, and the Canadian National Collections at Ottawa, Ontario, also contain valuable material.

To Dr. F. M. Root, recently deceased, I wish to express my sincere gratitude for the aid and interest so willingly given at all times, and for the many ways in which he has encouraged and guided me in my work. To Dr. J. M. Aldrich, also deceased, I am deeply indebted for the privilege of studying the material in the collection of the United States National Museum; and to Dr. A. Stone and Dr. H. Morrison, of the United States Bureau

of Entomology, for their valuable counsel, numerous suggestions, and for making available the necessary working facilities. It was my good fortune to be able to spend part of the time under Drs. O. A. Johannsen and J. C. Needham, of Cornell University, whose aid and assistance are greatly appreciated.

REVIEW OF THE SPECIES OF PSYCHODA OF NORTH AND CENTRAL AMERICA AND THE WEST INDIES

The genus *Psychoda* was erected in 1796 by Latreille, who placed it as the fourth in his family I of the Diptera. In this genus Latreille included *Tipula* Linnæus (Fabricius) (in part) and *Bibio* Geoffroy (Olivier) (in part) as synonyms. Latreille's definition of *Psychoda* is as follows:

> Antennes de la longeur des deux tiers du corps, de douze articles pyriformes, plumeux. Antennules longes, droites ou inclines, de quatre articles. Levres formant un bec pointu.
>
> Caracteres habituels. Tete petite, basse et arrondie; petits yeux lisses o. Ailes tres grandes, velvues, en toit.

The genus as originally defined did not include any species. In 1802 the same author recognized *Tipula phalænoides* Linnæus as the only representative of the genus *Psychoda*. Since no older designation of type for this genus is known and as it is a monotypic genus, *Tipula phalænoides* Linnæus is considered the type of the genus.

In 1904 Eaton divided the old genus into six smaller genera: *Philosepedon, Threticus, Logima, Telmatoscopus, Xenapates,* and *Clyticerus*. He characterized the old genus *Psychoda* as follows:

> Male antennae 14–16 jointed, with nodose flagellum composed of full-sized joints as far as the thirteenth joint of the antennae, followed by one, two, or three diminutive joints, and furnished with hair inserted upon the symmetrical or subsymmetrical nodes in verticils consisting of a series of 11 long-haired verticils closely moniliform, the eleventh including the diminutive joint or joints. Wings ovate-lanceolate, acute at the end of the median vein; subcosta very short and rudimentary, ending in the radius and not linked to the costa.

Tonnoir (1922) used Eaton's character of the structure of the tip of the antenna and concluded that the segment arising from segment 13 varies according to the individual, as Eaton believed. Tonnoir also used the presence or absence of hairs on the wing membrane or on the veins as a character. He proposed to reduce to subgenera the genera *Threticus, Logima, Philosepedon,* and *Xenapates*. In dealing with the North American and West Indian forms, it would be better to retain the old genus *Psychoda,* since, if we distribute the species in smaller genera, as proposed

by Eaton, or subgenera, as proposed by Tonnoir, it would evidently be necessary to establish new genera or subgenera peculiar to the North American continent.

The literature on the genus *Psychoda* in North America is scanty, although in Europe this genus has received the attention of such entomologists as Eaton and Tonnoir. Outside the work of Haseman (1907) little attempt at a comprehensive taxonomic study of this group has been made in this country, so that our knowledge of the number of species and of their distribution is very fragmentary. Haseman's treatise lists twenty-six species as belonging to the genus *Psychoda*. From Haseman's work, however, it has been difficult to decide whether some of his species belong to *Psychoda* or *Pericoma*. The location of Haseman's types is not known so that comparison of specimens could not be made. It is, therefore, somewhat difficult to state the exact number of species that Haseman described. In 1914 Banks published descriptions of two additional species of *Psychoda*. Curran in 1924 described four new species from Canada. Between that time and this there have appeared in various journals descriptions of some fifteen other species, four of which are from the West Indies and four from Central America.

Due to the great care that is necessary in preparing a collection of moth flies, specimens of them are usually rare in collections. Comparatively little is known of the distribution of the group on the North American continent. The forms that have been described have been collected in rather limited regions. Further collections in various areas will undoubtedly show that the number of undescribed forms is large.

Several workers who have dealt with this genus have recognized the difficulties encountered in the determination of the species and also the unsatisfactory nature of the descriptions given for the described species. The determination of the species is a rather difficult task, owing to the special technic necessary in the preparation of the specimens. For the study of such characters as the antennæ, wing venation, and genitalia, specimens cleared and mounted in the usual manner are not very satisfactory. To overcome this difficulty a number of methods of staining were tried, but the one that was most satisfactory and gave excellent mounts was the following: The specimen is immersed in 95 per cent alcohol for a few seconds,

placed in cold 10 per cent KOH, brought to a boil, washed in water, transferred to weak alcohol, brought up to absolute alcohol, equal parts of absolute alcohol and xylene, xylene and carbol-xylene with dissolved erythrosin (specimens may be left in this for an hour or more or overnight if the stain is diluted), transferred to clear carbol-xylene, then to balsam.

Careful examinations of prepared slides of the species that are apparently difficult to separate have been made in order that additional tangible characters may be utilized. Such characters as the structure of the tip of the labium or the tip of the paraglossæ have been found and used. It is hoped that these characters may be of value in the studies of this group of non-blood-sucking flies. Whether such characters will survive the test of wider application in the related groups remains to be determined.

As an aid in the search for little-known characters, which have been brought forth in the descriptive terminology used, and in order to have uniform measurements, the following explanations are given: The measurement between the eyes at the frons is taken at the place of least separation, unless otherwise mentioned; the width of the head is taken at its greatest width; the length of the wings is measured from the base of the costa, at the small semichitinous pad, to the tip; the width is taken at its widest part; the length of antenna is measured from the base of the first basal segment to the tip. All measurements mentioned in the paper are taken from slide preparations.

It will be seen that in the naming of the veins and cells of the wings the system introduced by Comstock and Needham has been employed. The merits and defects of this system of wing nomenclature are so well known that no justification for its use in this paper and for its deviation from the terminology of earlier workers is required. Although both Tillyard (1919) and Shannon and Bromley (1924) have proposed certain changes in the designation of certain veins in the above system, the terminology has not been elaborated. In the interest of uniformity and without causing any complication, the Comstock-Needham system will better fulfill the requirements. It has, therefore, been retained intact in the present systematic discussion. The terms used in this paper are given in text fig. 1.

Except for the structure of the tip of the labium or that of the paraglossæ, the characters used in preparing the synoptic key and in the discussion of the descriptions of the species are

chiefly those used in the literature and are usually self-explanatory. It has been the aim of the writer to center the discussion of specific characters on those which are of most importance in the identification of the species concerned or in its differentiation from those species with which it is likely to be confused in the North American fauna. Even the more obvious variations in the earlier descriptions in the literature are mentioned.

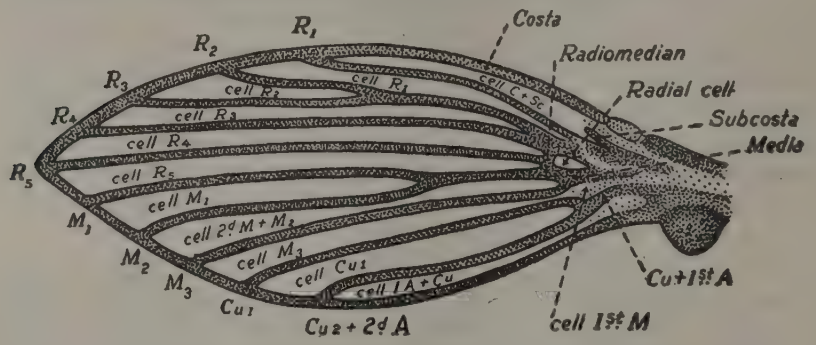

FIG. 1. Wing venation of *Psychoda*, showing terminology adopted for veins and cells.

The accompanying plates represent camera-lucida drawings by the author. It is a pleasure to acknowledge the generous assistance rendered by the National Museum artists of the Bureau of Science, Manila, Philippine Islands, in the preparation of the illustrations from the original drawings.

Synoptic key to the American species of the genus Psychoda.

1. Tip of labium not definitely enlarged, each lobe with long and short teeth at tip ..... 2.
   Tip of labium (paraglossæ) definitely enlarged, each lobe with short spinelike teeth on the inner surface..... 11.
2. Antennæ of sixteen segments ..... 3.
   Antennæ of fourteen or fifteen segments..... 7.
3. Last three segments of antennæ of reduced dimensions, about equal in size, all distinctly separated one from another..... 4.
   Last three segments of antennæ of reduced dimensions, unequal in size, at least two of them intimately united..... 5.
4. Ædeagus composed of two pieces, one broad with round end and one slender with pointed end; tip of labium with six teeth, four long and two short; inferior appendages of male bearing one spinule at about one-third the length of the appendage..... *cinerea* Banks.
   Ædeagus composed of a single, long, tubular piece about one and one-half times the length of the inferior appendages; tip of labium with one short and four long teeth; inferior appendages of male bearing one long spinule at about two-thirds length of the appendage. *interdicta* Dyar.

5. Segments 13, 14, and 15 of the antennæ intimately united; 14 and 15 much wider than long, ovoid ..... *marylandana* sp. nov.
Segments 13, 14, and 15 of the antennæ not intimately united ..... 6.
6. Segments 14 and 15 intimately united, both wider than long; 16 ovoid; sensory spine composed of two anterior branches and one posterior branch ..... *grisescens* Tonn.
Segment 14 intimately united with 13; 14 and 15 wider than long; sensory spine composed of three anterior branches and one posterior branch ..... *pusilla* Tonn.
7. Antennæ of fifteen segments ..... 8.
Antennæ of fourteen segments ..... 10.
8. Segment 14 distinctly separated from 13 and about equal in size to 15; tip of labium with two long and two short teeth, outer surface with two labial spines ..... *phalænoides* (Eaton).
Segment 14 intimately united to 13; 15 smaller than either 13 or 14; tip of labium with one short and four long teeth ..... 9.
9. Tips of several veins of wing with small patches of black or dark brown hairs; wings with a mottled appearance; outer surface of tip of labium with three labial spines ..... *alternata* Say.
Tips of veins without these spots; wings uniformly grayish white; tip of labium with two labial spines; both forks of wing weakly chitinized ..... *uniformis* sp. nov.
10. Wings without any markings; tip of labium with four labial spines; ventral plate not narrow near its base, lobes with rounded ends, their sides almost parallel ..... *severini* Tonn.
Wings with a black band; tip of labium with two labial spines; ventral plate narrowing near its base, lobes with pointed ends, their sides rather divergent ..... *sigma* Kinc.
11. Sensory spines of antennæ with three branches, two anterior and one posterior ..... 12.
Sensory spines of antennæ not of this shape ..... 15.
12. Inferior appendages with two terminal spinules, which are about two-thirds the length of the appendage; ædeagus with a long tubular piece, longer than the ninth tergite ..... *opposita* Banks.
Inferior appendages with one, three, or five terminal spinules, ædeagus without a long tubular piece ..... 13.
13. Antennæ of sixteen segments; 16 small, united to 15; inferior appendages with five terminal spinules; ædeagus with two lateral pieces triangular ..... *bishoppi* sp. nov.
Antennæ of sixteen segments; last four separated from each other by short necks; last three nearly of the same size ..... 14.
14. Inferior appendages with a single, long, clavate spinule; forks of wing not loosely chitinized ..... *fumata* Knab.
Inferior appendages with three long spinules; both forks of wings loosely chitinized ..... *tridactila* Kinc.
15. Antennæ of sixteen segments; last three segments small, with or without a small blunt end or toothlike projection ..... 16.
Antennæ of sixteen segments; last segment large, with a long slender spike ..... 19.

16. Last three segments of antennæ of about equal size; distinctly separated from each other; last segment without a blunt end or toothlike projection, lemon-shaped ..... 17.
    Last three segments of antennæ of unequal size; last segment with either a blunt end or a toothlike projection..... 18.
17. Sensory spines composed of two long branches, one anterior and one posterior; inferior appendages with three terminal spinules; ædeagus composed of three pieces..... *bicolor* Banks.
    Sensory spines composed of two, broad, leaflike branches; inferior appendages with two terminal spinules, length about two-thirds of the appendages; ovipositor of female composed of a broad plate with a blunt end ..... *helicis* Dyar.
18. Last two segments of antennæ of equal size; last segment with a blunt end; sensory spines composed of two, slender, leaflike branches; inferior appendages with thirteen to fifteen spinules; ædeagus peduncularely subovate ..... *olympia* Kinc.
    Last two segments of antennæ of unequal size, last segment with a toothlike projection; sensory spines comblike; third segment of antennæ with a subnode; inferior appendages with three spinules, edges serrated; ædeagus composed of three curved pieces.
    snowhilli sp. nov.
19. Sensory spines of antennæ fingerlike in shape, continuous round the node in male; with four or five branches in female; wings (male) heavily pigmented or with scalelike hairs near the base..... 20.
    Sensory spines with one or two anterior branches; wings not heavily pigmented ..... 22.
20. Wings heavily pigmented, giving a mottled appearance; legs annulated.
    autumnalis Banks.
    Wings not heavily pigmented; legs not annulated..... 21.
21. Wings with black and white hairs on the whole surface; black spots on tips of almost all veins; paraglossæ toothless.
    quadripunctata Banks.
    Wings without black and white hairs on the whole surface; male with scalelike hairs on the undersurface near the base; ædeagus clawlike, with a posterior plate having a notch at its tip.... *nigra* Banks.
22. Upper fork of wing distinctly before lower; segment 16 of antennæ without fingerlike projections near base of spike; ædeagus shaped like a tennis racket..... *albipunctata* Will.
    Forks nearly at same level; segment 16 of antennæ without fingerlike projection ..... 23.
23. Sc ending before level of r-m; sensory spines of antennæ composed of a single branch; tergite IX with one spiracular opening.
    superba Banks.
    Sc ending at the level of r-m; sensory spines composed of two branches; tergite IX with two spiracular openings.
    superba var. *conspicua* var. nov.

SPECIFIC DESCRIPTIONS

PSYCHODA ALTERNATA Say. Plate 1, figs. 1 to 5.

Psychoda alternata SAY, Long's Exp. St. Peter's River, App. (1824) 358.
Tipula phalænoides var. SCOP., Ent. Carn., No. 864 (1763) 324.
Trichoptera phalænoides MEIG., Klassif. d. Zweifl. 1 (1804) 43.
Psychoda phalænoides MEIG., System. Beschr. ed. 1 (1818) 104.
Psychoda sexpunctata CURTIS, Brit. Ent. 16 (1839) 745.
Psychoda marginepunctata ROSER, Corr. Wurt. landw. Ver. 1 (1840) 50.
Psychoda schizura KINCAID, Ent. News 10 (1899) 32.
Psychoda floridica HASEMAN, Trans. Am. Ent. Soc. 33 (1907) 316.
Psychoda nocturnala HASEMAN, Trans. Am. Ent. Soc. 33 (1907) 319.
Psychoda bengalensis BRUNETTI, Rec. Ind. Mus. 11 (1908) 370.
Psychoda albimaculata WELCH, Ann. Ent. Soc. Am. 5 (1912) 411.
Psychoda dakotensis DYAR, Insec. Inscit. Menst. 14 (1926) 107–110.

Male.—Occiput yellowish brown, border lighter, covered with long straight hairs varying from yellowish gray to white, in certain lights black. Eyes at frons separated by a distance equal to about the diameter of two facets. Frons and clypeus together triangular, yellowish brown, with a brush of whitish gray hairs. Proboscis about one-half the length of the head, covered with gray pruinescence. Tip of labium with four long teeth and one short tooth on each side, the latter about one-half the length of the former. In ordinary mounts the number and shape of the teeth cannot be made out easily, but if dissected and mounted under a separate cover glass the longest and the shortest teeth are found to be typically curved, with the tip more or less rounded. The longest teeth have an average length of 11.4 μ; the shortest an average length of 5.7 μ. Tip of the labium also provided with three spines on each side. Subequal in length, the longest about twice the length of the shortest teeth. Fine, slender hairs and microtrichia cover the whole surface of the labium. Palpi whitish yellow, about three times longer than the proboscis; first segment more yellow, about the same length as the second and third segments, provided with verticil hairs near the middle; second segment pale yellow towards the tip; third segment again pale yellow, greatly thickened distally; fourth with extreme apex whitish, slender, longer than any of the basal three segments. Antennæ whitish except for the first yellow basal segment; length equal to the width

of the wings; fifteen segments; segment 1 cylindrical, distinctly larger than any of the other segments, 2 more or less spherical, both 1 and 2 clothed with numerous fusiform scales as well as whorls of strong hairs; segments 3 to 12 flask-shaped, basal nodes about the same length as the adjacent slender clear internodes, over twice as wide as the diameter of the internodes, nodes each with four to five whorls of long white hairs projecting distally beyond the node of the adjacent distal segment; segment 14 one-half longer than 13, separated by a shallow weak constriction, coating of hairs similar to that of the middle segments; segment 15 small, ovoid, about one-half the length of 14; segments 14 and 15 closely joined. Antennal segments except the two basal and two apical each provided with two sensory spines (ascoid of Tonnoir), diametrically opposed. Each sensory spine with two well-developed anterior branches directed distad and slightly curved, and a posterior branch, slender, and in some basal segments much reduced. In the last segment of the antennæ the sensory spines are star-shaped with three branches, almost equal in length.

Thorax yellowish brown, thickly clothed with long, erect, mingled white and gray hairs. Wings ovate, rather pointed at extremity, thickly coated with alternate white and black patches of erect hairs on upper surface, moderate coating on lower surface. Mottled appearance arranged about as follows: (*a*) Black spots at tips of veins R_1, R_2, R_3, R_4, M_1 M_3, and $Cu_2 + 2d$ A; (*b*) a wide black strip suffused with dull yellow with indications of a distinct transverse black band at basal third of wing, the inner deflection extending into basal one-fourth of vein Cu_1 forming a distinct black tuft, the outer deflection extending into middle of vein $Cu_2 + 2d$ A; (*c*) indications of black band in middle region of wing formed by black spots on basal half of R_2, basal two-thirds of R_3, basal two-thirds of R_4, M_1, and M_3; (*d*) white spots occupying all intermediate spaces on surfaces between black spots. Fringe on wing margin smoky, anterior fringe about one-third width of wing, posterior fringe about one-half width of wing. On ventral surface the hairs are short, dull yellow, and reclined. Sc short, gently arcuate, as long as Rs. Origin of $R_2 + R_3$ on the same line as r-m. Fork R_2 R_3 at about four-fifths of the wing length. Fork M_1M_2 at about three-fifths the wing length, a little closer to fork $R_2 + R_3$ than to r-m. Halteres white with a yellow stem. Legs pale yellow to whitish; coxæ, trochanters, and femora yel-

lowish; fore tibiæ with dorsal side dark brown; middle and hind femora whitish, dorsal side with several stout, dark brown, scalelike hairs; tarsal segments except for the white speckling usually darker, ventral surface, especially of the middle and hind pairs, partly or almost completely covered with short, prostrate, whitish, scalelike hairs. All feet provided with small, equal, and untoothed claws.

Abdomen reddish brown, dorsal surface of tergum towards base paler than the remaining parts. Each abdominal segment thickly clothed dorsally with a ringlike series of mingled white and gray erect hairs; ventral surface covered with fine, slender, whitish hairs. Hypopygium yellowish brown, ninth tergite (basis of Haseman) well developed, longer than the eighth tergite, about as long as broad, slightly broader at caudal end; inferior appendages (cercopods of Tonnoir), swollen at base, gradually tapering, slightly curved, about twice as long as the ninth tergite, heavily fringed with grayish white, erect hairs towards base; terminal spinule (tentacles of Eaton) about one-tenth length of appendage, flat, wider at the apex. Superior appendages (gonopods or forceps of Tonnoir) with two subequal segments, the first one strongly developed, with a bump in the middle on its outer face; the second segment sickle-shaped, a little longer than the first, slightly expanded inward at the middle, its tip pointed, slightly curved. Ædeagus constructed of two subequal parts.

Length of body, 1.40 mm; width of head, 0.40 mm; length of wing, 1.60; width of wing, 0.60; length of antennæ, 1.20.

Female.—Distinctly larger than the male; head and thorax slightly more yellowish brown; abdomen slightly brown, whitish towards base. Antennæ slightly shorter than in male, basal two segments yellowish brown, middle segments grayish white, the three apical segments slightly more grayish; nodes notably longer than the internode, as long as broad; sensory spines well developed and strongly curved. Thorax robust, dull yellowish brown, more densely coated with thick white and gray hairs. Arrangement of spots in wing as in the male but the spots are much darker. Abdomen considerably more developed than in the male, as densely clothed as the thorax, with similar thick bristlelike hairs. Ventral plate yellowish brown, U-shaped. Ovipositor darker than the plate, twice as long as plate, consisting of two pieces loosely compressed laterally, pointed, curved upward.

Length of body, 1.50 mm; width of head, 0.50; length of wing, 1.70; width of wing, 0.80; length of antennæ, 1.00.

ILLINOIS, Chicago, October 25, 1912 (Welch's types of *albimaculata*). WASHINGTON, Seattle, September 1, 1898 (Kincaid's cotypes of *schizura*). NEW HAMPSHIRE, Franconia (*Mrs. A. T. Slosson*). MARYLAND, Plummer's Island, August 14, 1902 (*H. S. Barber*); Cabin John Bridge, June 17, 1928 (*H. G. Dyar*); Baltimore, December 12; 1932 (*F. M. Root*); Back River, June 20, 1922 (*F. M. Root*); College Park, August 26, 1933 (*F. C. Bishopp's* light trap); Towson, May 7, 1924 (*F. M. Root*); Baltimore, December 12, 1932 (*F. del Rosario*). VIRGINIA, Falls Church, June 7, 1914 (*R. S. Shannon*). PENNSYLVANIA, Allentown, November 17, 1915 (*P. A. Mader*). NEW MEXICO, Las Vegas, September, 1894 (*T. D. A. Cockerell*); Las Cruces, September, 1894 (*T. D. A. Cockerell*). TEXAS, El Paso, October, 1923 (*R. E. Tarbett*), "Suspected of carrying fever." KANSAS, Lawrence (*J. M. Aldrich*). OHIO, Dayton, July 6, 1928 (*G. Goodhue*). MONTANA, St. Charles, 1926 (*M. J. Brown*). CALIFORNIA, Palm Springs, March 24 to 26, 1918 (Cornell University collection). DISTRICT OF COLUMBIA, Washington, November, 1909 (*H. S. Barber*).

Reported also from Calcutta, India, March 4, 1913 (Baker's collection, cotypes of *bengalensis* Brunetti); Madeira, February, 1925 (*T. D. A. Cockerell*); Olaa, Hawaii (*W. H. Ashmead*, 2,000 feet elevation); Brookings, South Dakota (*J. M. Aldrich*, type specimens of *dakotensis* Dyar).

This species is evidently very widespread and cosmopolitan. Haseman reported it as occurring throughout the United States.

Tonnoir considers *tripunctata* Macquart as a synonym of *alternata* Say, but I cannot agree with him. Macquart's figure (pl. 12, fig. 2) shows that the fork of R_2R_3 in the wing is much closer to the base than the fork of M_1M_2; the wing shows four longitudinal veins after the second forking; the length given is 3 to 4 lines, or about 6 to 8 mm, which is unusual for a *Psychoda*.

Psychoda alternata and the following nine species are members of a group possessing long and short teeth at the tip of the labium. In this group the lobe of the tip of the labium is not expanded into a bulblike structure and each lobe possesses not more than four labial spines. *Psychoda alternata* is easily recognized by the mottled appearance of the wing and the peculiar structure of the tip of the antennæ, which is very distinctive.

PSYCHODA PHALÆNOIDES (Linnæus, 1758) Tonnoir. Plate 1, figs. 6 to 10.

Psychoda phalænoides (Linnæus, 1758) TONNOIR, Ann. Soc. Ent. 62 (1922) 67–68.
Tipula phalænoides LINNÆUS, Syst. Nat. ed. 10 No. 32 (1758) 588.
Psychoda pacifica KINCAID, Ent. News 8 (1897) 143.
Psychoda tonnoiri DYAR, Insec. Inscit. Menst. 14 (1926) 105.

Male.—Occiput brown, clothed with long yellowish gray hair. Eyes at frons separated by a distance equal to about the diameter of one facet. Frons and clypeus together are triangular with rounded corners, brown, covered with erect, whitish hairs. Proboscis about one-half the length of the frons and clypeus combined, light brown, with golden pubescence. Tip of labium with three long teeth and one short tooth on each side of the lobe. The shortest is slightly pointed and is about one-half the length of the longest teeth. The longest teeth have an average length of 9 μ, the shortest an average length of 4.6 μ. Tip of labium with two prominent straight spines subequal in length. Palpi gray, about four times longer than proboscis; first segment darker, about the same length as the fourth segment; second and third segments decidedly gray, of about the same length, with more verticil hairs, especially in the middle; fourth segment grayish white, slender, longer than second or third segment. Antennæ brown, as long as width of wing; fifteen segments; segment 1 cylindrical; 2 globular, closely applied to segment 1, both 1 and 2 with verticillate grayish white hairs and fusiform scales; segments 3 to 12 flask shaped, basal nodes spherical, distinctly shorter than their adjacent internodes; nodes covered with five or six whorls of grayish white hairs reaching as far as the adjacent distal internodes; segment 13 of about the same size as segment 12, but not provided with the internode. Segments 14 and 15 of about the same length, distinctly separated from each other and from 13; 13 and 14 each with a small protuberance toward the anterior side bearing a short pointed spine. One pair of ascoids present on all the segments except on the two basal and the two terminal segments; they are bifurcate with a basal appendage slightly smaller and shorter.

Thorax brown, covered with thick bristly, grayish white hairs, with some darker hairs intermixed. Wings ovate-lanceolate, slightly obtusely rounded at apex, very pale gray, nearly clear round the posterior border. Veins with the usual row of gray hairs, with some darker, nearly erect hairs placed in irregular

rows and patches near the base of the wing; a small bunch of dark bristly hairs at the base. Costal border clothed to the tip of the wing with stiff gray hairs; toward the wing base the wing fringe becomes darker; fringe at the posterior margin toward the base becomes smoky gray and from thence towards the border to the tip of the wing the fringe becomes grayish white. Sc about one-third longer than the semichitinous pad above it and equal to about three-quarters the length of Rs. Origin of $R_2 + R_3$ on R_4 distinctly after fork of Rs. Fork $R_2 + R_3$ at middle of wing length; fork M_1M_2 a little beyond middle of R_2R_3, a little closer to fork R_2R_3 than to r-m; tip of R_1 slightly beyond level of tip of $Cu_2 + 2d$ A. Halteres whitish gray with few appressed gray hairs; knob about one-half length of stem. Legs of uniform coloration similar to that of the body; femora and most of tibiæ with whitish gray hairs, distal third of tibiæ and tarsal segments darker when seen in certain positions, latter covered with short, broad, somewhat prostrate, white hairs, appearing as scales.

Abdomen darker than the thorax except for the dorsum which is paler; dorsum with thick, erect, whitish gray hairs; hairs on the lateral margins more or less reclined. Hypopygium pale brown, surrounded by long gray hairs. Ninth tergite about as long as eighth tergite, slightly distended in the middle portion; longer than broad. Inferior appendages about twice as long as the ninth tergite, slender, curving ventrally, swollen slightly near base and gradually tapering toward an acute point; terminal spinule minute, clavate, much wider towards the apex. Superior appendages 2-segmented; basal segment swollen near base; second segment almost as long as the basal, slender, tapering to an acute point, with short and weak spines above and below. Ædeagus about as long as second segment of superior appendage, rather tubular, basal half broad, rounded at tip.

Length of body, 1.50 mm; width of head, 0.30; length of wing, 0.50; width of wing, 0.60; length of antennæ, 0.90.

Female.—Similar to the male. Eyes at frons not as close as in the male. Proboscis less than half the frons and clypeus combined. Antennæ shorter than in the male, but the form and shape of the terminal segments identical. Abdomen darker than in the male, but the hairs not so uniformly distributed. Ventral plate brown, with numerous gray hairs and several scattered straight hairs, nearly twice as long as broad, ending posteriorly in two rounded lobes with deep emargination between them; ovipositor of same color as ventral plate, slightly

curved upward, with a few scattered spines along margin of basal third.

Length of body, 1.70 mm; width of head, 0.40; length of wing, 2.00; width of wing, 1.00; length of antennæ, 1.30.

IDAHO, Moscow (*J. M. Aldrich*, two specimens, one bearing a label *cinerea* Banks). CALIFORNIA, Stanford University, February 2, 1906 (*J. M. Aldrich*); Eureka, May, (*H. S. Barber*); Fieldbrook, May 18, 1903 (*H. S. Barber*); Summit, May 15, 1921 (*H. S. Barber*); Pasadena, February 24, 1909 (*F. Grinnell*). WASHINGTON, Seattle, March 22, 1898, (Kincaid's cotypes of *pacifica*); Longmire Springs, June 10 and 11, 1917 (*H. G. Dyar*). DISTRICT OF COLUMBIA, Washington, May 20, 1905 (*H. S. Barber*). ALASKA, St. Paul Island (Kincaid's cotypes of *pacifica*). BRITISH COLUMBIA, Lowes Inlet, 1899 (*Harriman Expedition*, Kincaid's cotypes of *pacifica*). ALBERTA, Banff, July 15, 1918 (*H. G. Dyar*). NEW MEXICO, Las Vegas, August 19, 1907 (*H. S. Barber*). WISCONSIN, Beloit (*C. L. Turner*). COLORADO, Grand Lake, June 20, 1923 (*H. G. Dyar*). MARYLAND, College Park, August 26, 1933, September 19, 1933 (*F. C. Bishopp's* light trap); Baltimore, November 6, 1932 (*F. del Rosario*).

The synonymy given above is based upon that published by Latreille, Kincaid, and Dyar. The description given by Latreille relates largely to characters of a general nature, and details that, in the light of our present knowledge of the members of the group, are of little value in separating it from other species. Kincaid's description of *Ps. pacifica* agrees so closely with Tonnoir's description of *Ps. phalænoides*, especially as to the segments of the antennæ, and with his cotypes at my disposal, that I have no hesitation in placing it as a synonym of the latter species. Dyar (1926), in his description of the psychodids from the Glacier National Park, recognizes the *phalænoides* of Eaton and Tonnoir, not of Linnæus, as *tonnoiri*, and has interpreted Linnæus's *phalænoides* as the "common or official" form. Dyar's long list of synonyms includes *Ps. degenerans* Walker, *Ps. cinerea* Banks, *Ps. minuta* Banks, *Ps. pallens* Williston, *Ps. pacifica* Kincaid, *Ps. elegans* Kincaid, *Ps. longifringa* Haseman, *Ps. domestica* Haseman, *Ps. severini* Tonnoir, and *Ps. prudens* Curran. Curran 1930 (1931) believes that Dyar was wrong when he included *Ps. prudens* as a synonym of *phalænoides*, since the male genitalia are very different in the two species. In the same paper Curran states:

Dyar would upset the work of Tonnoir in regard to the name of our common species and would call *phalaenoides* Tonnoir *Ps. tonnoiri.* This, of course, he has no right to do, since Tonnoir was the first to revise the species, and he had a perfect right to limit the name *phalaenoides* in what seemed to him the proper way. Dyar has merely complicated matters and added another name to the synonymy of *phalaenoides.* If Dyar's synonymy for his *phalaenoides* is correct, the proper name for our North American species would be *degenerans* Walker but, inasmuch as we are certain of the identity of *cinerea* Banks and know nothing of *degenerans,* I have used that name. I do not, however, think that all the names placed in the synonymy by Dyar belong there and a thorough study of the genus will probably prove that there are several species concerned. Dyar's suggested synonymy throughout the family needs verification and should be seriously considered at the present time.

PSYCHODA CINEREA Banks. Plate 1, figs. 11 to 15.

Psychoda cinerea BANKS, Can. Ent. 26 (1894) 331.
Psychoda elegans KINCAID, Ent. News 8 (1897) 144.
Threticus compar EATON, Ent. Mo. Mag. II 15 (1904) 57.
Psychoda domestica HASEMAN, Ent. News 19 (1908) 285.
Psychoda compar (Eaton) TONNOIR, Ann. Soc. Ent. Belg. 62 (1922) 67–69.
Psychoda prudens CURRAN, Can. Ent. 46 (1924) 219.

Male.—Occiput light brown, covered with short grayish brown hairs. Eyes at frons separated by a distance equal to the diameter of one facet. Frons pale brown, rather kidney-shaped, clothed with straight and slightly curved bristly hairs, brush appearing dark when viewed from above and yellowish brown when seen from the sides. Clypeus hexagonal, with its widest side forming a distinct suture which separates it from the frons. Proboscis pale yellow, slightly longer than the first palpal segment. Tip of labium provided with six teeth and five spines. Teeth arranged about as follows: First about two-thirds length of second and about a third longer than the fourth, which is the shortest; second and third of about same length as the fifth and sixth, their distal ends rounded. The spines are arranged as in *Ps. phalænoides* or *Ps. severini.* The clothing of hairs around the teeth much thinner and microtrichia much longer than in *phalænoides, severini,* or *alternata.* Palpi about four times the length of proboscis, light brown, with short whitish hairs; first segment shortest, cylindrical; second barely longer than the first, nearly club-shaped; third slightly longer and broader than the second; fourth the longest, slightly tapering to a sharp point. Antennæ 16-jointed, one and a half times the width of the wing, nodes light brown, with grayish hairs appearing of equal width throughout the whole length of the antennæ; basal segment almost as broad as long, distended at

middle portion on one side, covered with brown whorls of hairs; segment 2 spherical, smaller than 1 and like the basal segment with brown whorls of hairs; segments 3 to 12 with nodes slightly enlarged, shorter than the internodes, whorls of grayish hairs on each node; segment 13 with a distinct rather short neck; segments 14 to 16 much reduced, slightly broader than long, closely applied to each other. Sensory spines seen in segments 3 to 13 are of the usual type with two long anterior branches and a slender and slightly shorter posterior branch.

Thorax pale yellowish brown, anterior margin of dorsum clothed with a thick brush of gray and blackish hairs; pleuræ bare except for a few yellowish gray hairs at the base of the root of the wing. Wings acutely pointed, with cinereous hairs on the veins. Semichitinous pad at base of costa blackish with gray hairs; fringe on anterior margin smoky, shorter than that on posterior margin. Bases of veins on the lower surface of the wings highly chitinized. Sc short, about one-third longer than the semichitinous pad above it. End of R_1 a little beyond middle of wing. Origin of $R_2 + R_3$ distinctly before level of r-m. Fork M_1M_2 much closer to either origin of R_2R_3 or r-m than to fork R_2R_3. Base of halteres white, knob grayish white. Legs light brown, femora and tibiæ with appressed, long, gray hairs above, rather silvery gray or dark in certain lights; tarsal segments with appressed, white, scalelike hairs; claws of moderate size, equal and simple as in other members of this group.

Abdomen light brown on dorsum, lateral margin dull white. Tergites, except the last three or four, clothed with a thick set of gray hairs intermixed with long pale silvery hairs; hairs on pleuræ yellowish, rather fine. Hypopygium pale brown, covered with whitish hairs. Ninth tergite about as long as broad, slightly wider at basal one-third. Inferior appendages nearly as long as the ninth tergite, club-shaped, swollen at basal two-thirds, tapering towards the end; terminal spinule cylindrical, somewhat curved inwardly, about one-third as long as the inferior appendages. Basal segment of superior appendages stout, swollen at middle portion; distal segment over one-half as long as basal segment, slender, slightly enlarged at basal one-third; distal portion gently tapering to an acute point. Second segment of superior appendages with a single, long, slender spine or bristle. Ædeagus composed of two processes, one rather broad before the middle, its margin somewhat folded on one side, with a rounded point, the other about as long as

the first, intimately attached to the first at its base, tapering to a sharp point.

Length of body, 1.20 mm; width of head, 0.30; length of wing, 1.60; width of wing, 0.70; length of antennæ, 1.20.

Female.—In coloring like the male, but the pleura of the intermediate abdominal segments distinctly whiter. Second antennal segment much broader than long. Area immediately below the base of the root of the wing pale yellow. Hind tibiæ and first tarsal segment with long grayish hairs more pronounced than in the male. Anterior margin of the knob of the halteres white. Ventral plate light brown, with short, gray, appressed hairs, much broader than long, slightly emarginate, ending distally in two semicircular lobes. Ovipositor reddish brown, shining, slightly curved.

Length of body, 1.70 mm; width of head, 0.40; length of wing, 1.80; width of wing, 0.80; length of antennæ, 1.00.

NEW YORK, Long Island, Banks's type, *4311 U. S. Nat. Mus.* (types of *cinerea*, two specimens); Ithaca, March 27, 1933, April 10, 1933 (*F. del Rosario*); Brooklyn June 11, 1912 (*A. C. Weed*). WASHINGTON, Seattle, March 22, 1898 (Kincaid's cotypes of *elegans*). DISTRICT OF COLUMBIA, Washington, May 10, 1911 (*F. K. Knab*). MASSACHUSETTS, Cambridge, May 1870 (no label for collector). INDIANA, Lafayette, April 20, 1915 (trap lantern, collector unknown). VIRGINIA, Richmond, 1920 (*Wm. D. Richardson*); Glencarlyn, May 9, 1909 (*F. K. Knab*). MARYLAND, Plummer's Island, May 16, 1909 (*F. K. Knab*); Cabin John Bridge, May 16, 1909 (*F. K. Knab*).

This is evidently the species that Tonnoir described as *Ps. compar* Eaton. Tonnoir's figures of *compar* agree exactly in the more important structural characters with the type of *cinerea*. An unpublished figure of the male genitalia of *Ps. prudens* Curran, kindly presented to me by Doctor Curran, agrees very well with the male hypopygium of *cinerea*, so that I do not hesitate to place it here as a synonym.

In general appearance this species is very similar to *phalænoides* or *severini*, but the number of segments of the antennæ, the arrangement of the last three antennal segments, the number of teeth at the tip of the labium, and the structure of the male genitalia at once distinguish it.

PSYCHODA SEVERINI Tonnoir. Plate 1, figs. 16 to 21.

Psychoda severini TONNOIR, Ann. Soc. Ent. Belg. 62 (1922) 78–81.
Psychoda phalænoides (Linnæus, 1758) DYAR, Insec. Inscit. Menst. 14 (1926) 105.

Male.—Occiput brownish, with erect yellowish gray hairs. Eyes separated by a distance equal to about the diameter of two facets. Frons and clypeus combined triangular, brown, with pale brownish yellow, bristly hairs. Proboscis about two-thirds as long as the frons and clypeus combined, rather broad at base, tapering into a sharp point, yellowish brown with gray hairs. Tip of labium with four long teeth and one short tooth, first tooth about as long as the fourth, third tooth longest and about twice the length of the shortest; the longest with an average length of 12 μ; the shortest with an average length of 6.1 μ; the tip of the labium is provided with four labial spines arranged about as follows: One about twice the length of the tooth lying below the bases of the second and third teeth; second of about same length as the first, lying below the fourth tooth; third and fourth much shorter and closer to the margin. Fine slender hairs and microtrichia covering the whole surface of the tip of the labium, very distinct. Palpi yellowish gray, palpal segments of same length except the fourth which is longer by about the length of the third or second segment. Antennæ light brown, surrounded by yellowish gray bristly hairs. Verticils of yellowish gray hairs lying closely to the segments, directed forwards, clustering together, giving the antennæ a somewhat solid appearance with parallel sides; first basal segment short, cup-shaped, second segment much broader than long, both segments encircled by leaflike hairs; segments 3 to 12 flask-shaped, nodes much broader than long, distinctly shorter than adjacent internodes, whorls of hairs like those of *Ps. phalænoides;* segment 13 with a short neck bearing on one side and close to the base of 14 a toothlike projection armed with a single short spine; 14 small, ovoid. Sensory spines similar to those of *phalænoides;* they are not found on the first two basal segments or on the last segment.

Thorax light brown, covered with long, pale yellowish gray, bristly hairs, plentifully intermixed with almost white hairs. The hairs on the anterior border of the dorsum show a tendency to be arranged in bushlike sets, on the posterior border they are arranged in three rows, the middle row arranged in fan-shaped sets parted in the middle; the rows on each side of the middle row are made up of long and short, erect hairs. Pleuræ brown, shining, bare or nearly so. Wings rather broad, with apex somewhat rounded, having the appearance of being pale gray, wholly unmarked; veins distinct, each with the usual double row of hairs, which appear dark when viewed from above

and white when viewed horizontally from the tip of the wing. Hairs on the semichitinous pad along base of costa, long, thickly set, nearly black. Sc barely longer than the semichitinous pad above it. Fork of R_2R_3 at middle of wing length, a little beyond level of tip of R_1. Origin of $R_2 + R_3$ on the same level as r-m. Fork of M_1M_2 a little closer to fork of R_2R_3 than to r-m. Halteres clothed with gray hairs on the knob and with grayish white appressed hairs on the stem. Legs light brown, femora with some whitish hairs below, the tibiæ rather closely covered with grayish white hairs, the tarsi with white hairs which, towards the tip, are replaced by small elongated white scales.

Dorsum of abdomen brown, lateral margin lighter, clothed with yellowish gray hairs, a thick set of hairs on the dorsum of first abdominal segment. Towards the genitalia the hairs are arranged in fan-shaped sets. Hypopygium light, with long bristly hairs. Ninth tergite longer than broad, a little broader toward the distal portion. Inferior appendages one and one-half times longer than the ninth tergite, basal fourth swollen and rounded externally, gradually tapering towards the end where it carries a short, rather spatulate, spinule; superior appendages 2-jointed, proximal segment somewhat stout, middle portion slightly enlarged, distal segment slightly swollen at the base and with the distal half provided with one long spine and several short ones, gently undulating, their apex moderately pointed. Ædeagus formed of two, long, sharply pointed processes, one rather longer than the other and somewhat broader before the middle, the other curved gently from basal third.

Length of body, 1.20 mm; width of head, 0.30; length of wing, 1.60; with of wing, 0.70; length of antennæ, 1.40.

Female.—In coloring like the male. Proboscis less than two-thirds the length of the frons and clypeus combined. Teeth on the tip of the labium rather more prominent but their size and shape as in the male. Last segment of the antenna without a toothlike projection near its base. Hair on the dorsum of the thorax arranged in about the same fashion as in the male. Abdomen as in the male but the lateral part of the dorsal conjunctiva, the first tergite, and all sternites, except the last two or three, light brown. Wings not as broad as in male, showing a tendency to be less rounded at apex. Fork of R_2R_3 slightly before the middle of the wing. Fork of M_1M_2 just as close to fork of R_2R_3 as to r-m. Ventral plate with two pronounced lobes, the depth about one-third the distance between the two

lobes; the external surface is covered with strong spines and microtrichia.

Length of body, 2.40 mm; width of head, 0.40; length of wing, 2.50; width of wing, 1.10; length of antennæ, 1.10.

BRITISH COLUMBIA, Kaslo, June (*R. P. Currie, H. G. Dyar*). NEW MEXICO, Las Cruces (*T. D. A. Cockerell*). DISTRICT OF COLUMBIA, Washington, May 16, 1911 (*F. K. Knab*). CALIFORNIA, Eureka, May (*H. S. Barber*). MARYLAND, Plummer's Island, April, May (Schwarz collection). MONTANA, Glacier National Park, July, August (*H. G. Dyar*). ENGLAND, London, July 27 (*Brunetti*, 1888).

This species was originally described in 1922 by Tonnoir. In 1926 Dyar remarked—

> Tonnoir . . . described as new the common 14-jointed antennal form as *severini*. We think that when other indication is lacking Linnæus species should be taken to be the "common or official" form, and we have therefore interpreted *phalaenoides* in this sense.

Dyar's attempt to solve the problem indicates that he was not aware of the fact that Tonnoir was the first reviser and naturally had the right to interpret the naming of the species.

PSYCHODA PUSILLA Tonnoir. Plate 2, figs. 1 to 5.

Psychoda pusilla TONNOIR, Ann. Soc. Ent. Belg. 62 (1922) 83–84.

Male.—Occiput dull brown, covered with slightly curved gray hairs. Eyes at frons separated by a distance equal to about two and one-third times the diameter of one facet. Frons and clypeus together triangular, brown, with light gray hairs. Proboscis well developed, shiny brown, with gray pruinescence, one-half the width of the head. Tip of the labium with three long teeth and one short tooth, the latter about one-half the length of the former. On each side of the tip of the labium are two long spines subequal in length, microtrichia, and fine slender hairs, which are more prominent along the margin. Palpi pale brown, with whitish yellow hairs; palpal segments are in the proportions of 15 : 12 : 13 : 18. Antennæ of sixteen segments, brown, with gray whorls of hairs, about twice the width of the wing; segment 1 cylindrical, distinctly larger than any of the other segments; 2 spherical; segments 3 to 12 flask-shaped, basal nodes a little less than one-fifth shorter than the adjacent internodes, about three times larger than the diameter of the internodes; whorls from nodes barely reaching the node of distal adjacent segment; segment 13 of about the same diameter as

the middle segments and very intimately united with 14, which is about one-third its size; segment 15 much wider than long, also intimately connected to 14; segment 16 almost spherical, with indication of a neck separating it from 15. Antennal segments 3 to 13 each provided with a pair of sensory spines diametrically opposed; each sensory spine shaped like a fork with three slender branches directed anteriorly and a short branch directed posteriorly.

Thorax brown, with gray hairs more pronounced on the anterior margin of the dorsum. Wings ovate, broad, rather pointed at apex, uniformly clothed with smoky gray hairs; hairs of posterior fringe longer and more erect than those of the anterior. Sc a third longer than the semichitinous pad above it. Origin of $R_2 + R_3$ on the same line as r-m. Fork of R_2R_3 about the middle of wing; before the extremity of $Cu_2 + 2d$ A, weakly chitinized. Fork of M_1M_2 almost as near to r-m as to fork of R_2R_3, also very weakly chitinized. Vein R_5 well developed and heavily chitinized. Halteres yellowish white with microtrichia and short gray hairs; stem much shorter than the knob. Legs about the same color as body; hairs covering them somewhat lighter than on body; middle and posterior tibiæ each with a row of long, erect, spinelike hairs on its inner and outer surfaces; those on the middle portion of the segments longest, and those of the outer row longer than those of the inner; femur and tibiæ rather sparingly clothed with closely applied hairs; tarsi covered with light scalelike hairs which appear white in reflected light.

Abdomen pale brown, lateral membrane dusky, posterior margins of segments darker brown. Each abdominal segment with short, erect, scattered grayish hairs. Hypopygium yellowish brown; ninth tergite well developed, nearly circular when viewed from above; caudal end with a triangular flap. Inferior appendages slender, slightly swollen at base and gradually tapering. Terminal spinule flat and wider at apex, about one-fourth of the length of inferior appendages. Basal segment of the superior appendages strongly developed, stout, slightly swollen at the middle; distal segment almost as long as the basal segment, slender, slightly curved, tapering to an acute point and bearing a few groups of spines. Ædeagus formed of two processes, one stout, rather tubular, slightly distended in middle and with round apex; the other slender, curved, ending in a sharp point. The two processes are united at their bases.

Length of body, 0.90 mm; width of head, 0.27; length of wing, 0.98; width of wing, 0.38; length of antennæ, 0.80.

Female.—Similar to the male in coloring and in structure of the antennæ, tip of the labium, and wing venation. Ventral plate hidden beneath the hairs of the posterior end of the abdomen, yellowish brown at tip, black toward base, much broader than long, terminating posteriorly in two finely pubescent lobes with a slight emargination between; anteriorly it is densely clothed with gray hair; ovipositor moderately long, almost straight.

Length of body, 0.95 mm; width of head, 0.29; length of wing, 1.03; width of wing, 0.41; length of antennæ, 0.57.

KANSAS, Lawrence, 4 males and 1 female; these are pinned specimens that are classified as *Ps. phalænoides* in the United States National Museum; the name of the collecter is not shown. MARYLAND, College Park, September 5, 1935, 1 female (*F. C. Bishopp's* light trap).

This is a small species easily recognized by the tip of the antennæ and the sensory spines. *Psychoda pusilla,* originally described from upper Austria, is here first reported in this country. Although I have not examined Tonnoir's specimens of *pusilla,* his figures of the species agree in all details with the specimens before me.

PSYCHODA GRISESCENS Tonnoir. Plate 2, figs. 6 to 11.

Psychoda grisescens TONNOIR, Ann. Soc. Ent. Belg. 62 (1922) 87–88.

Male.—Head, proboscis, and antennæ dirty grayish brown. Eyes narrowly separated at frons by a distance equal to about three-fifths the diameter of one facet. Frons and clypeus almost semicircular, surface covered with yellowish gray hairs. Proboscis short, about one-fourth the width of the head. Tip of the labium with three long teeth and one short tooth, the short tooth a little over half the length of the longest teeth; surface covered with microtrichia; two subequal spines very prominent on each side of the tip. Palpi dull brown, distal half clothed with grayish white hairs; first segment slightly enlarged basally, a little longer than the second or third segment; terminal segment longer than any of the other three segments. Antennæ of sixteen segments, a little longer than the width of the wing; basal segment cylindrical, slightly longer than broad; segment 2 globular; segment 3 smaller than 2, flask-shaped, diameter of the node four times that of the internode; segments 4 to 12

like 3, gradually diminishing in size; the segments clothed with scattered gray hairs; 13 globular with a very short neck; 14 and 15 very intimately connected, the former much wider than long, slightly larger than the latter, which has the same shape; 16 ovoid, distinctly separated from 15 by a short neck. The sensory spines on segments 3 to 12 are of the usual type with two anterior and one posterior branch; the branches, however, are strongly curved into an S-shape at their basal third.

Thorax yellowish brown, in front densely clothed with short, slender, gray hairs; behind, at base of wings, the hairs long, lighter, almost white. Wings narrower than in *pusilla* but not acutely angular at tip; above, veins evenly clothed with gray hair, similar to that of the body; below, base of veins with a few, scattered, dark gray hairs, followed by slender hairs of the same color, which extend to the tip of the wing; anterior fringe smoky, darker toward base; posterior fringe lighter, having a yellowish cast. Sc broad, almost twice as long as the semichitinous pad above it. Origin of $R_2 + R_3$ distinctly before r-m. Fork of R_2R_3 about the middle of the wing but before the extremity of $Cu_2 + 2d$ A. Fork of M_1M_2 weakly chitinized, much closer to fork of R_2R_3 than to r-m. Vein R_5 not well developed and heavily chitinized as in *pusilla*. Knob of halteres yellowish white with fine, short, grayish hairs; stem club-shaped with several slender whitish hairs. Legs dull brown, clothed with gray hairs; a number of long, dark gray hairs scattered over the tibiæ; tarsi with grayish white, scalelike hairs.

Abdomen brown, venter of first segment and anterior incisures broadly pale brown; dorsal surface of tergum towards base darker than the remaining parts; hairs on abdominal segments uniformly grayish white. Hypopygium pale brown, densely covered with grayish white hairs. Ninth tergite longer than broad. Anal flap at caudal end very similar to that of *pusilla*. Inferior appendages swollen basally, gradually tapering towards the tip, about one and one-half times as long as the length of the ninth tergite. Terminal spinule small, a little over one-fourth the length of the inferior appendages. First segment of superior appendages cylindrical, slightly swollen on its outer side; second segment much longer than the first, curved into a sharp pointed end. Ædeagus very similar to *pusilla;* composed of two parts; one long process, cylindrical, with rounded apex; the other a sharp process very much shorter and coiled around the first.

Length of body, 1.41 mm; width of head, 0.32; length of wing, 1.36; width of wing, 0.61; length of antennæ, 0.88.

Female.—Very similar to the male. Eyes at frons closer than in the male. Palpi at their distal half clothed with almost white hairs. Antennæ somewhat darker at the basal half; the whorls of hairs are much denser than in the male. Thorax appears more yellowish and the hairs on the dorsum are more thickly set; a few scattered yellowish hairs on the pleuræ. Abdomen darker than that of the male; tips of hairs on posterior segments nearly white. Ventral plate longer than broad, slightly constricted in the middle; distal end cleft so as to have a bilobed appearance. Ovipositor not twice as long as plate, darker than the plate, curved downward.

Length of body, 1.50 mm; width of head, 0.36; length of wing, 1.40; width of wing, 0.69; length of antennæ, 0.85.

JAMAICA, Kingston, 5 females and 2 males, received by the author from Dr. F. M. Root, January 5, 1934; specimens deposited in the United States National Museum.

PSYCHODA INTERDICTA Dyar. Plate 2, figs. 12 to 16.

Psychoda interdicta DYAR, Proc. Ent. Soc. Wash. 30 (1926) 87–89.

Male.—Occiput dull brown, widened medially, covered with erect grayish white hairs; anterior margin with a single row of long hairs. Eyes at frons separated by a distance equal to half the diameter of one facet. Frontal triangle dull brown, semicircular in outline, thickly covered with bushlike, erect, grayish white hairs. Clypeus brown, slightly convex medially, much wider than long, whole surface with erect grayish white hairs; outer margin close to the eyes provided with five long spinelike hairs. Proboscis pale brown, about as long as second palpal segment. Paraglossæ of medium size, provided with four short teeth near the apex; membranous area with from five to seven long spines. Theca heavily chitinized. Palpi and antennæ of the same coloration as clypeus; segments of the palpi are in the proportion of 5:8:9:10. Antenna of sixteen segments, with whorls of gray hairs lying closely to the segments, thus giving it a solid appearance; basal segment rather tubular, slightly widened anteriorly; segment 2 somewhat spherical; segment 3 club-shaped, node slightly longer than its internode; segments 4 to 12 almost flask-shaped; segment 13 with a very small neck; segments 14 and 15 of about the same size, separated from each other by a small neck; segment 16 ovoid, bearing a

short stout spine at its apex and several slender spines around it. Sensory spines on segments 3 to 13 of three branches; two long anterior branches slightly curved basally, reaching almost to half of the following node; a slender posterior branch extending a little over the length of its node.

Dorsum of the thorax dull brown to bronze; surface covered with long whitish hairs with grayish tips. Scutellum somewhat pale brown but with some coating of hairs on dorsum of the thorax. Pleuræ pale yellowish brown. Wings a little over twice as long as broad, slightly angulated at apex. Vestiture of wings smoky. Anterior fringe dark gray, darker towards the base. Posterior fringe lighter except for a thick smoky patch near the base. Sc short, origin of $R_2 + R_3$ distinctly before the level of r-m. Fork R_2R_3 at the middle of the wing. Fork M_1M_2 before the middle of the wing, about as close to r-m as it is to fork R_2R_3. Cell C + Sc darker than the rest of the cells in the wing. Halteres yellowish. All coxæ and trochanters pale brown; femora and tibiæ darker with dark gray hairs on anterior surface, appearing bluish in certain reflected lights; posterior surface with short and much lighter hairs. Anterior surfaces of tarsal segments with dark gray hairs; in reflected light the scalelike hairs appear whitish from above.

Abdomen brown dorsally; sides bronzed; venter and hypopygium pale brown; covering of hairs dark gray, heavy towards the posterior end. Ninth tergite slightly longer than broad, caudal flap very hairy. Inferior appendages slightly swollen basally, curved inwardly; terminal spinule long, about two-thirds the length of the inferior appendages. Basal segment of superior appendages somewhat triangular; distal segment cylindrical, widened basally, apex bluntly rounded, with a single long hair, whole surface of the segment covered with long slender hairs. Ædeagus composed of a single long process, its margin somewhat folded. Length of the ædeagus about one and one-half times that of the superior appendages.

Length of body, 1.90 mm; width of head, 0.38; length of wing, 1.82; width of wing, 1.96; length of antennæ, 1.27.

Female.—Covering of hairs decidedly darker than in the male. Eyes at frons separated by a distance equal to one and one-half times the diameter of one facet. Semichitinous pad well developed and heavily chitinized. Tip of vein M_1 with a slight indication of a blackish spot. Cell C + Sc highly pigmented. Abdomen darker than in the male. Ventral plate gently emar-

ginate; basally with a pair of small lobes. Ovipositor short and somewhat curved.

Length of body, 2.00 mm; width of head, 0.38; length of wing, 1.96; width of wing, 1.23; length of antennæ, 0.81.

NEW YORK, Ithaca, September 5, 1916, 7 specimens of both sexes, types, *40516 U. S. Nat. Mus.*, from Cornell University collection. MARYLAND, College Park, August 13, 17, 26, 1933 (*F. C. Bishopp's* light trap), September 5, 15, 19, 1933 (*F. C. Bishopp's* light trap); Solomon Island, August 19, 1933 (*F. C. Bishopp's* light trap); Baltimore, Roland Park, June 1 to 7, 1934 (*F. M. Root*); Annapolis, St. John College, August 12 and 16, 1933 (*F. C. Bishopp's* light trap); Indian Head, August 16, 1933 (*F. C. Bishopp's* light trap); Berlin, August 17, 1933 (*F. C. Bishopp's* light trap); Salisbury, September 25, 1933 (*F. C. Bishopp's* light trap). WEST INDIES, Santa Lucia, Gastries, September 10 to 22, 1919 (*J. C. Bradley*).

The description of *Ps. uniformata* as given by Haseman might apply to this species, although in his description of the antenna Haseman mentioned that it was of fifteen segments with a terminal spike.

PSYCHODA MARYLANDANA sp. nov. Plate 2, figs. 17 to 21.

Male.—Head from above appearing nearly rounded; occiput, frons, and clypeus brown; hairs covering them yellowish gray; occiput narrow. Eyes at frons separated by a distance equal to more than one-fifth longer than the diameter of one facet. Frontal triangle kidney-shaped, brown, covered with thick-set hairs on its basal half. Antennal fossæ prominent. Clypeus about as long as broad, slightly convex on its anterior margin; at its apex terminated by a narrow castaneous margin. Proboscis dark brown, with grayish white hairs, slightly longer than the first palpal segment. Tip of the labium with three long teeth and one short tooth, the latter about one-half as long as the former; outer margin with two spines subequal in length, the whole surface covered with microtrichia and fine slender hairs. Palpi pale brown with grayish white hairs; first three basal segments of about equal length; the terminal segment about one and one-half times as long as the third; second and third slightly widened. Antennæ of sixteen segments, dark brown, with grayish white hairs. Basal segment short, slightly swollen on one side, slightly longer than 2, which is globular. Segments 3 to 12 of about the same size and shape as in *pusilla* or *uniformis*. Tip of the antennæ similar in construction to *trinodulosa* Tonnoir. Sensory spines of three branches, two

anterior branches nearly touching the base of the node of the following segment and a short, rather weak, slightly pointed, usually straight, posterior branch.

Dorsum of the thorax blackish, covered with erect, yellowish gray hairs, more thickly set towards the scutellum. Pleuræ dull brown, with a few short, scattered, whitish hairs. Wings lanceolate uniformly yellowish gray, whitish gray in some reflected lights. Anterior and posterior fringes appear darker due to their thick pile. A bunch of erect gray hairs at the base of the wing on the undersurface. Sc slightly longer than the semichitinous pad above it. Origin of $R_2 + R_3$ a little after the level of r-m. Fork R_2R_3 a little before the middle of the wing, much closer to fork M_1M_2 than to r-m. Fork M_1M_2 weakly chitinized, much closer to r-m than to fork R_2R_3. Knob of halteres whitish; stem yellowish gray. Legs pale brown; anterior and posterior margins of mid- and hind femora, apical half of their tibiæ, and all tarsal segments darker. Hairs on femora and tibiæ short, appearing yellowish gray.

Tergites of abdomen blackish; incisures pale brown; pleural membrane and basal two-thirds of the venter brown; hairs yellowish white, somewhat longer on the anterior surface of two basal segments, with a few long, almost white, hairs. Ninth tergite somewhat semicircular at its distal end, basally narrowing into a broad neck. Inferior appendage swollen near the base, slightly curved, tapering gradually, its apex bearing a single spinule. Basal segment of superior appendages not well developed, slightly curved medially; distal segment somewhat enlarged at the middle, distal half tapering into a clawlike point, near the apex it is provided with two long and three or four short spines. Ædeagus composed of a spatulate structure rounded at tip and a small pointed piece with a pair of triangular processes immediately beneath, the upper ends of the plates somewhat bent on one side.

Length of body 1.00 mm; width of head, 0.29; length of wing, 0.96; width of wing, 0.40; length of antennæ, 0.91.

Female.—Very similar to the male. Tip of the labium with teeth not as long as in the male. Proboscis longer than in the male. Ventral plate blackish, lobes conical, distance between the apex of the lobes twice the depth of the emargination; medially a tubular structure appearing attached to a heavily chitinized plate. Ovipositor black, slightly curved, strongly chitinized basally.

Length of body, 1.2 mm; width of head, 0.25; length of wing, 1.00; width of wing, 0.45; length of antennæ, 0.61.

MARYLAND, College Park, September 5, 1933, and August 26, 1935, 13 females and 1 male (*F. C. Bishopp's* light trap). The type material will be deposited in the United States National Museum.

This is a small species occurring with *phalænoides, cinerea,* and *uniformis.* In general appearance a dry specimen is very similar to *pusilla* and *uniformis.* Resembles the European *trinodulosa* in the form of the tip of the antenna and wing venation, although it is otherwise very different.

PSYCHODA UNIFORMIS sp. nov. Plate 2, figs. 22 to 25.

Female.—Occiput, frons, and clypeus brown, uniformly covered with grayish white hairs. Distance between the eyes at frons three-tenths in excess of the diameter of one facet. Frontal triangle rather heart-shaped, wider than long; clypeus slightly wider than long. Proboscis slender, about as long as the last palpal segment, with short almost appressed grayish white hairs. Palpi pale brown covered with yellowish gray hairs; the three basal segments about equal in length; the last segment slightly longer than the third, slightly pointed apically. Tip of labium with four long teeth and one short tooth, the shortest teeth nearly two-thirds as long as the longest, with more or less rounded tips; two spines on the membranous surface of the tip. Microtrichia rather scanty near the attachment of the teeth. Antennæ dark brown with whorls of grayish white hairs; fifteen segments; segment 1 slightly longer than broad; 2 spherical, broader than long; 3 to 12 flask-shaped, size of the node gradually diminishing towards the tip; node of segment 13 like the nodes of the middle segments with just an indication of a broad neck, 14 much smaller than 13, globular; 15 ovoid, smaller than 14. Sensory spines on segments 3 to 13 consist of two anterior branches reaching as far as the joint of the following segments.

Anterior dorsum of thorax brown, uniformly covered with grayish white hairs; the sides in front and the pleuræ pale brown; scutellum dark brown. Wings rather ovate, slightly pointed at apex. Wing fringe grayish white. Hairs on the veins of the usual type. Sc short, about as long as the semichitinous pad above it. Fork $R_2 + R_3$ after the middle of the wing, very weakly chitinized. Fork M_1M_2 also weakly chiti-

nized, distinctly before the middle of the wing. Halteres small; knobs grayish white. Legs brown; femora scantily covered with grayish white hairs; tibiæ and last tarsal segment slightly darker, covering of hairs more grayish.

Abdomen castaneous to blackish; the lateral margins, fifth segment, and apices of the segments shining, whole surface covered with grayish white hairs. Sides of first segment broadly dull black. Second segment with a broad, median, blackish area on the dorsum. Venter brown. Ventral plate much broader than long, with shallow emargination apically; the lobes produced, rather conical. Ovipositor bladelike, slightly concealed, length about three times the distance between the tips of the lobes.

Length of body, 1.30 mm; width of head, 0.26; length of wing, 1.16; width of wing, 0.47; length of antennæ, 0.33.

MARYLAND, College Park, August 26 and September 5, 1933, 15 specimens (*F. C. Bishopp's* light trap). The type material will be deposited in the United States National Museum.

This is one of the smallest species in the North American fauna and may possibly be either *Ps. minuta* Banks or *Ps. uniformata* Haseman. Since *minuta* and *uniformata* have evidently not been recorded since their description, the evidence as to the identity of this species is suggestive though not final, and if it should prove to be the same as *minuta* or *uniformata*, the form to which the name is here assigned would become *Ps. minuta* or *Ps. uniformata*. However, until Bank's type or Haseman's type (neither of which, in all probability, exists) can be studied carefully, it will not be possible to determine definitely the status of this species.

PSYCHODA SIGMA Kincaid. Plate 3, figs. 1 to 4.

Psychoda sigma KINCAID, Entom. News 10 (1901) 31.
Psychoda surcoufi TONNOIR, Ann. Soc. Ent. Belg. 62 (1922) 74–76.

Female.—Occiput, frons, and clypeus light brown; occiput with whitish hair and a few yellowish hairs. Distance between the eyes at frons about equal to the diameter of two facets. Frontal triangle pronounced, with yellowish hairs arranged about the middle region between the antennal fossæ. Clypeus slightly wider than long. Proboscis short, nearly as long as the first palpal segment, with short, appressed, whitish hair. Palpi pale brown, covered with yellowish hairs; ratio of palpal segments: 18 : 22 : 23 : 30. Tip of the labium with four long teeth and one short tooth; the shortest about two-thirds as long as the longest.

Outer surface of the tip with two spines and microtrichia that are rather indistinct near the base of the teeth. Antennæ of fourteen segments, pale brown, with verticils of yellowish hairs; segment 1 subcylindrical, slightly longer than wide; 2 globular; segments 3 to 12 flask-shaped, nodes globular, diminishing in size towards the tip; internodes of each segment slightly longer than the diameter of the node; segment 13 somewhat globular; 14 ovoid; segments 13 and 14 separated by a short neck, which is hardly swollen but bears two short spines. (Tonnoir considers this as a true segment, but I cannot agree with him as there is no clear line of demarcation to delimit it as a true segment.) Sensory spines like those of *phalænoides*, with two anterior branches and one posterior branch.

Mesonotum pale brown, with cream-colored hairs arranged in three rows; pleuræ pale yellow. Wings over twice as long as broad, slightly angulated at tip. Anterior and posterior fringes dense and yellowish except for two patches of smoky hair at the anterior and posterior ending of the irregular band which is shaped like an inverted V with the pointed end directed towards the tip of the wing. Sc short. Origin of $R_2 + R_3$ on the same level with r-m. Fork M_1M_2 closer to fork R_2R_3 than to r-m, origin of the stem before r-m. Halteres small, knob with grayish white hairs. Legs pale yellow with yellowish hairs.

Abdomen pale brown with yellowish white hairs, the lateral margins somewhat darker but also covered with yellowish white hairs. Venter brown, covering of hairs grayish. Ventral plate narrow near its base but gradually widening posteriorly into equal lobes, which are separated by a deep emargination. Ovipositor brown, long, pointed, and slightly curved.

Length of body, 1.01 mm; width of head, 0.45; length of wing, 1.87; width of wing, 1.05; length of antennæ, 1.05.

I have not examined the male; the original description is as follows:

> Male: Smaller than female, with the black band upon the wings less clearly evident. Genitalia conspicuous, brown, clothed with long cream-colored hair. Inferior appendages 3-jointed; joint 1 (ninth tergite) stout, cylindrical; joint 2 twice as long as 1, slender, slightly swollen at base, curving upwards; joint 3 very slender, cylindrical, tapering at apex. Superior appendages not as long as the basal joint of inferior; 2-jointed; joint 1 stout; joint 2 tapering to an acute point.

Type locality, Olympia, Washington, June 24 to July 1, 1897.

I have studied one female determined by Kincaid, from Seattle, Washington, January 6, 1900.

There can be no doubt that *sigma* is the valid name and that *surcoufi* is a synonym of it. The description and figures of *surcoufi* as given by Tonnoir agree very closely with my figures of *sigma*.

PSYCHODA BICOLOR Banks. Plate 3, figs. 5 to 10.

Psychoda bicolor BANKS, Can. Ent. 26 (1894) 333.

Psychoda nigra (Banks) DYAR, Proc. Ent. Soc. Wash. 30 (1928) 87–89.

Male.—Occiput, frons, clypeus, and the two basal antennal segments yellowish white, covered with erect white hairs. Occiput broad. Eyes at frons well separated by a distance equal to a little more than the diameter of three facets. Frontal triangle large, much wider than long, gently convex. Clypeus much wider than long, shallowly emarginate, receding below medially, the oral margin slightly produced. Proboscis yellowish brown with short yellowish hairs, about three-fourths the length of the first palpal segment. Palpi slender, pale brown, with short dark gray hair, about one-third the length of the antennæ. First palpal segment short, second segment about twice the length of the first, the third rather stout, a little over the length of the second and about as long as the fourth segment. Paraglossæ much like those of *autumnalis* Banks, with seven, pointed, spinelike teeth on each side at the proximal margin. Spines on the outer margin close to the tip more numerous and well developed. Antennal segments bronzed except for two yellowish white basal segments; segments 3 and 4 covered with yellowish gray hairs, remaining segments with dark gray hairs. Basal segment of antennæ about as broad as long; segment 2 spherical, strongly united to the first; segment 3 long, greatest diameter at about one-half of the segment, node gradually narrowing basally, about twice the length of the internode, its greatest diameter about three times the diameter of the internode and about three-sevenths the length of node. Segment 4 club-shaped, node slightly longer than the internode, diameter of the node about one-half its length and about three times the diameter of the internode. Nodes of segments 5 to 12 gradually increasing in diameter with a corresponding decrease in length, the internodes progressively increasing in length; internodes of segment 12 about one-third the length of the node; segments 14 and 15 about one-third the size of segment 12, distinctly separated from each other by a short internode. Last segment lemon-shaped, of same size as segment 14

or 15, separated from 15 by a short internode. Sensory spines, one on each side of segments 3 to 13, composed of two branches—a long anterior branch, which is bladelike, broad at base and gradually tapering, slightly curved at its basal third; a short, slender, posterior branch about one-half the length of the anterior branch.

Mesonotum yellowish brown, anterior margin lighter; lateral margins and all of the pleura yellowish white; scutellum yellowish brown. Hairs on the thorax white with a few, scattered, grayish white hairs. Knob of halteres grayish white, stem whitish; covering of hairs dark gray, with a little over twice as long as broad, acutely pointed at apex. Anterior fringe evenly dark gray or blackish; posterior fringe of same color as anterior fringe, but the hairs are much longer. Hairs on wing veins uniformly dark gray or blackish. On the undersurface, at about basal one-half, the veins are covered with short, blackish, scalelike hairs. Sc about two and one-half times the length of the semichitinous pad. Origin of $R_2 + R_3$ before the level of r-m. Fork R_2R_3 a little beyond the middle of the wing. Fork M_1M_2 weakly chitinized, much closer to r-m than to fork R_2R_3. Legs pale brown, with dark gray hairs; coxæ and trochanters yellowish white with several grayish hairs. Tibiæ of the forelegs covered with long blackish hairs; first tarsal segment clothed with short gray hairs; hairs on the remaining tarsal segments short, appressed, scalelike, grayish white. Mid- and hind femora with uniform dark gray hair; tibiæ with many long and slender yellowish hairs, hairs on the tarsal segments appear grayish white in certain reflected lights.

First three abdominal segments wholly pale brown, the median portion blackish with dark gray hairs. Fourth and remaining abdominal segments dark grayish brown with dark yellowish gray hair. Hypopygium pale brown with a dense covering of white hair. Ninth tergite about as long as broad, slightly wider at base. Inferior appendages slightly swollen at base, gradually tapering toward the apex, about as long as the ninth tergite, the whole surface covered with numerous straight spines; apex bearing three terminal spinules; middle spinule slightly longer than the two others and about one-half the length of the inferior appendages. Superior appendages of two segments; basal segments stout, heavily chitinized with abundant, fairly long, scalelike hairs on the outer surface; the inner surface on the apical fourth with a single long spine almost as long as the second

segment of the superior appendages; second segment of superior appendages slightly curved, over twice as long as the basal segment, slightly enlarged basally, becoming slender toward the apex. Ædeagus strongly developed and heavily chitinized; composed of two, long, acutely pointed processes, one rather clawlike at tip, the other strongly curved almost to an S-shape with a very short, rather toothlike, blunt tip.

Length of body, 2.80 mm; width of head, 0.45; length of wing, 2.76; width of wing, 1.18; length of antennæ, 2.38.

Female.—Resembles the male. Eyes at frons more widely separated than those of the male. Paraglossæ more prominent. Tips of the antennæ similar to those of the male. Wings more acutely pointed at apex, with no blackish scalelike hairs on the basal half of the undersurface. Ventral plate very shallowly emarginate, the corresponding lobes wide; anterior margin rounded, their membranous tips provided with several long and short spines. In the region of the anus is an anal flap, rather tubular in form, bearing five long spines nearly equal in length, their apices almost reaching the margin of the plate.

Length of body, 2.95 mm; width of head, 0.50; length of wing, 2.91; width of wing, 1.23; length of antennæ, 2.00.

NEW YORK (*N. Banks*), type locality; McLean Reservoir, August 27, 1925 (no collector given), June 10, 1933 (*F. del Rosario*); Ithaca, June 1, 1933 (*F. del Rosario*). MARYLAND. College Park, August 14 and 19 and September 13, 1933 (*F. C. Bishopp's* light trap); Cabin John Bridge, May 16, 1909 (*F. Knab*); Plummer's Island, July 26, 1909 (*F. Knab*). DISTRICT OF COLUMBIA, Washington, May 22, 1914 (*F. Knab*). INDIANA, Lafayette, August, 1917 (*J. M. Aldrich*).

Dyar (1926), on the supposition that the specimens from New York, which Banks (1894) described as *bicolor*, represented the male of *nigra*, included the former as a synonym of the latter. This was wrong, as I have collected specimens of both sexes of both of these species, which prove to be entirely distinct. As stated above, the female of *bicolor* resembles the male very closely, differing only in coloration and in structural characters.

PSYCHODA NIGRA Banks. Plate 3, figs. 11 to 16.

Psychoda nigra BANKS, Can. Ent. 26 (1894) 331.
Psychoda marginalis BANKS, Can. Ent. 26 (1894) 333.
Psychoda apicalis BANKS, Proc. Ent. Soc. Wash. 8 (1906) 148–151.
Psychoda basalis BANKS, Proc. Ent. Soc. Wash. 8 (1906) 148–151.

Pericoma orillia CURRAN, Can. Ent. 56 (1924) 218.
Psychoda varitarsis CURRAN, Can. Ent. 56 (1924) 220.
Maruina nigra (Banks) DYAR, Insec. Inscit. Menst. 14 (1926) 111.
Pericoma apicalis (Banks) DYAR, Insec. Inscit. Menst. 14 (1926) 149.
Psychoda nigra (Banks) DYAR, Proc. Ent. Soc. Wash. 30 (1928) 87–89.

Male.—Head black, thickly covered with a brush of white hairs on the frons, clypeus, and occiput; the hairs on the occiput vary gradually to dark gray on the sides; two lobes resembling the breathing tubes of *Anopheles* pupæ project from behind the occiput, coloration like that of the occiput. Eyes at frons separated by a distance equal to the diameter of two facets. Frontal triangle reddish, much wider than long, lobes at the antennal fossæ acutely rounded at apex. Clypeus reddish, narrowed apically. Proboscis pale brown, slightly longer than the first palpal segment. Palpi blackish, densely covered with a tuft of short, bluish black, scalelike hairs, first palpal segment shortest, last three segments of about equal length, the third moderately swollen. Paraglossæ similar to those of *bicolor*, with five teeth on each side arranged in a single row; a somewhat irregular transverse row of twelve long spines along the sides of these teeth. Antenna dark brown to black, with dark gray verticils about twice as long as broad, with a brushlike covering of black hairs on its inner surface; segment 2 nearly globular, with a blackish tuft on its inner surface; segments 3 to 15 rather flask-shaped, the nodes nearly globular, internodes slightly shorter than the diameter of the node; sensory spines similar to those of *autumnalis* Banks; the branches, however, are finer and slender; segment 16 with a terminal spike or stylet.

Thorax dark brown; mesonotum darker, sides and anterior margin more or less brown; center of scutellum dark brown; pleuræ pale brown; hairs on dorsum of thorax dark gray, those on the sides blackish. Halteres dull though not dark brown; knob with short, appressed, blackish hairs; stem short. Wings over twice as long as broad, slightly bluntly rounded at tip and terminating close before the end of R_3. Basal half of anterior fringe dark gray, the distal half smoky; posterior fringe long, blackish basally and evenly smoky towards the apex. Hairs on the veins dark grayish brown except those at basal one-seventh which are grayish white. Hairs on the undersurface at basal one-half black, distinctly scalelike. Hairs on semi-chitinous pad grayish white. Sc long, a little over the length

of $R_2 + R_3$ from its point of origin to its fork. Origin of $R_2 + R_3$ at about one-third the length of the wing, much closer to r-m than to fork M_1M_2. Fork M_1M_2 close to the middle of the wing. Cells C + Sc and 1st A + Cu heavily chitinized, dotted with the roots of the blackish hairs. Coxæ and trochanter pale brown, with dark gray hairs on the outer surface. Femora of forelegs brown, covered with blackish hairs; posterior margin with a row of ten to twelve bristles. Fore tibiæ and tarsal segments brown, covered with black to dark gray hairs, the inner surfaces lighter. Mid- and hind tibiæ brown with both short and long black hairs; the long hairs appear gray or smoky when examined under diffused light; hairs on tarsal segments like those on the forelegs.

Abdomen dark brown; hind margins blackish medially; thickly set with dark gray and blackish hairs. Hypopygium dark brown, sparsely set with grayish white hairs. Ninth tergite about as long as broad; distal end with two subequal anal flaps. Inferior appendages stout, almost cylindrical, slightly swollen basally, gently curved with a group of about thirteen to sixteen spinules on the undersides close to the apex; at about the middle on the undersurface are two long slender spinules, a little over one-half the length of the inferior appendages. Basal segment of superior appendages short, stout, rather enlarged basally; distal segment slightly longer than the first, also slightly swollen at base, gradually tapering into a clawlike tip. Ædeagus made up of two long curved processes sharply pointed at tip. On the upper surface of the ninth tergite and intimately associated with the basal segment of the inferior appendages is a chitinized plate about as long as the basal segment of the inferior appendages, rather elliptical in shape, with a notch at the tip. It possibly is a part of the genital armature.

Length of body, 2.28 mm; width of head, 0.47; length of wing, 2.20; width of wing, 0.83; length of antennæ, 1.60.

Female.—Palpi lighter than those of the male; antennal segments not as large as in the male; nodes rather elliptical, with a whorl of long grayish hairs. The sensory spines like those of *autumnalis* Banks, with fingerlike branches, usually five. Undersurface of wings without black scalelike hairs. Wings narrower than those of the male; anterior and posterior fringes blackish. Femora of forelegs without bristles on their posterior margins. Hairs on the anterior margin of the tarsal segments of the legs not as black as in the male. Ventral plate not prominent, being concealed by the long black hairs of the venter

of the abdomen; shallowly emarginate, the notch hardly one-half as deep as the distance between the lobes. Ovipositor about twice as long as the width of the plate and a little curved.

Length of body, 2.41 mm; width of head, 0.50; length of wing, 2.29; width of wing, 1.03; length of antennæ, 1.01.

VIRGINIA, Falls Church, May 3 (*N. Banks,* type of *apicalis*), May 7, 1906 (*N. Banks,* type of *basalis*); Glencarlyn, May 9, 1909 (*F. Knab*). INDIANA, Lafayette, July 16, 1915 (*J. M. Aldrich,* a slide preparation made from this specimen by Dyar is labeled *Ps. basalis*). MARYLAND, Cabin John Bridge, May 16 and August 22, 1909 (*F. Knab*); College Park, August 26, 1933 (*F. C. Bishopp's* light trap); Snowhill, August 26, 1933 (*F. C. Bishopp's* light trap); Plummer's Island, May 10, 1905 (*Barber and Schwartz*). NEW YORK, Ithaca, June 1, 1933 (*F. del Rosario*); Long Island (*N. Banks,* types of *Ps. marginalis*). QUEBEC, Megantic, June 18, 1923 (*C. H. Curran,* paratype of *Pericoma varitarsis*). ONTARIO, Orilia, June 26, 1926 (*C. H. Curran,* specimen is determined as *Ps. orillia* by Curran). MAINE, Orono, June (*Cornell University collection*). NEW HAMPSHIRE, Franconia (*A. T. Slosson*). NEW JERSEY, National Park, May 6, 1909 (no collector). OHIO, Cuyuga Falls (*W. V. Warner*).

This species has been described by Banks under four different names since 1894, and Dyar in 1926 placed it under the genus *Maruina.* However, in a recent paper (1928) Dyar reaffirmed his determination making *Maruina nigra* (Banks) a synonym of *Ps. nigra* Banks. In the same paper Dyar included *Ps. apicalis* Banks, *Pericoma apicalis* (Banks) Dyar, *Ps. orillia* Curran, and *Ps. varitarsis* Curran as synonyms of *Ps. nigra* Banks. Upon working over the material in the United States National Museum, which includes the types and paratypes, I find that *marginalis* and its synonyms as given by Dyar are true *nigra* Banks. A careful study of the type of *basalis* Banks shows that it also is *nigra.* The evidence as to the identity of the *nigra* of Banks is based upon the comparison of the tip of the antenna, wing venation, and structural characters of the male hypopygium with the different synonyms given above.

PSYCHODA OPPOSITA Banks. Plate 4, figs. 1 to 5.

Psychoda opposita BANKS, Can. Ent. 33 (1901) 274.

Male.—Occiput wholly brown, with pale gray hairs on the sides and a group of white hairs on the posterior margin; on the anterior margin, close to the side of the eyes, is a row of about

eight to ten long hairs. Frontal triangle brown, with dark gray hairs confined to the center of the triangle. Eyes at frons almost confluent, facets near frons arranged in four rows. Clypeus much wider than long, dark brown, clothed with long, dark gray hairs; on each side close to the posterior margin of the eye is a row of five strong hairs. Proboscis about as long as the first palpal segment, brown, with short dark gray hairs. Paraglossæ bulblike in shape; posterior arm of theca longer than the two anterior arms, well chitinized; furca heavily chitinized; inner surface of paraglossæ on each lobe with three strongly developed teeth more or less spinelike; outer surface with four long spines. Palpi with short, appressed, grayish hairs; palpal segments of about equal length. Antennæ pale brown, with grayish hairs; towards the basal segments the hairs are darker. Verticils on the nodes slightly compressed and lying parallel to the length of the segments. First basal segment very slightly longer than broad and about as long as segment 2, which is globular; nodes of segments 3 to 6 longer than their internodes, globular; sensory spines on each segment consist of three branches, two long anterior branches and a shorter branch. (The number of segments and the structure of the tip could not be made out as the tips apparently have been broken in the pinned specimen.)

Mesonotum brown, with white hairs; pleuræ brown, apparently bare. Wings lanceolate, acute at tip, clothed with pale grayish white hairs. Anterior fringe almost white; posterior fringe longer than the anterior, the hair on the former mostly pale grayish white. Three distinct dark areas on the wings distributed as follows: A broad, irregular, black area of erect black hairs near the base; a small black spot formed also of erect black hairs near the end of vein R_2 and another black spot similar to that on R_2 near the end of M_3 just above the tip of Cu_1. The two small black spots are exactly opposite each other with a rather indistinct dark fascia joining them. The extreme tips of R_5 and M_2 with indications of black spots. The hairs on the veins are mostly pale grayish white. Knob of halteres pale yellow with whitish hairs. All legs pale brown, uniformly clothed with dark gray hairs, except the anterior margin of each tibia, which is brownish.

Abdomen dark brown, clothed with dark gray hairs. Venter lighter and covered with short whitish hairs. Ninth tergite about as long as broad, moderately swollen near the middle region; toward the caudal region is a circular area distinctly

with microtrichia. Basal segment of inferior appendage longer than broad, slightly enlarged about the middle portion; distal segment clawlike, longer than the basal, tip with two short hairlike spines. Superior appendages rather tubular, except near the apex where they begin to taper and bear two clavate spinules; the spinules about two-thirds as long as the basal appendage; whole surface of the inferior appendages covered with straight hairlike spines. Ædeagus consists of a long tubular piece reaching almost to the tip of the superior appendages and a basal plate with two, sharp-pointed, toothlike projections.

Length of body, 1.73 mm; width of head, 0.38; length of wing, 1.53; width of wing, 0.54; length of antennæ (six basal segments), 0.47.

Female.—In coloring resembling the male but with the integument of the mesonotum nearly black. Abdominal tergites with brown transverse fasciæ which do not reach the incisures. Ventral plate nearly as broad as long; posterior lobes distinctly separated by a deep notch; outer surface of the lobes with long bristles. Ovipositor about two and one-half times the width of the ventral plate, distinctly curved and pointed.

Length of body, 1.92 mm; width of head, 0.40; length of wing, 1.63; width of wing, 0.58; length of antennæ, 0.38.

DISTRICT OF COLUMBIA, Washington, August 17 (*H. Barber*). MARYLAND, Plummer's Island, January 25, 1907 (*W. V. Warren*, determined as *Ps. opposita* by N. Banks).

PSYCHODA SUPERBA Banks. Plate 4, figs. 6 to 11.

Psychoda superba BANKS, Can. Ent. 26 (1894) 332.

Male.—Occiput, frontal triangle, and clypeus black; occiput with white hairs. Eyes at frons separated by a distance equal to about the diameter of one facet. Frontal triangle widening towards the clypeus, covered with black hairs. Clypeus slightly convex, broader than long, lateral margin with a row of four stout hairs. Proboscis a little longer than the first palpal segment, clothed with short blackish hairs. Paraglossæ with four short teeth on each side of the lobe and about seven long stout spines on the outer surface. Furca heavily chitinized. Posterior stem of theca shorter than the anterior arms. Palpi black; palpal segments in the proportion of 5 : 12 : 9 : 8. Antennæ of sixteen segments; node of each segment black, with blackish hairs; verticils of hairs on the nodes somewhat compressed; segment 1 cylindrical, slightly longer than broad; 2

subglobular; node of segments 3 to 15 slightly globular, diameter of each node equal to about the length of its internode; segment 16 with a spike, which is covered with microtrichia, and close to the base of the spike are eight fingerlike projections, their length equal to that of the spike. All the segments of the antennæ except the two basal segments are provided with elongated, S-shaped, sensory spines; each node having two spines, their origins very closely approximated to each other.

Thorax black, shining; mesonotum and upper portion of pleuræ with snow-white hairs; posterior portion of mesonotum with black hairs. In some specimens all the mesonotum is covered with white hairs. Wings ovate, slightly angulated at tip. Anterior and posterior fringes nearly black, whitish near the tip of the wing. Tips of all veins with small black patches of hair and white patches between them. Before the black patch at the tip of each vein is a small white patch. A band of erect white hairs at the base of the wing. Bases of veins R_1, R_4, R_5, $M_1 + M_2$, and $Cu_2 + 2d$ A with white hairs. Patches of white hairs are also found on costa just above tip of Sc and at about the middle of vein R_1. At about two-thirds of veins R_2, R_3, and R_4, middle of R_5, and at two-thirds of M_1 and M_3 some white hairs are also present. Sc long, about one-half the length of R_1. Origin of $R_2 + R_3$ before the middle of the wing and a little behind the level of the end of $Cu_2 + 2d$ A but before the level of r-m. Fork $M_1 + M_2$ slightly before the level of fork R_2R_3, nearer to fork R_2R_3 than to r-m. Halteres small, black, knob with dark grayish hairs; stem slender, with yellowish hairs. Legs black with black hairs; tips of tibiæ and first and second tarsal segments with white rings.

Abdomen dark gray with dark grayish hairs. Incisures whitish, also covered with dark grayish hairs. Venter pale brown with decidedly gray hairs. Hypopygium with long dark gray hairs and a few scattered black hairs. Ninth tergite much broader than long, with a single spiracular opening. Anal flap nearly one-third the length of the inferior appendages, evenly rounded at the tip. Inferior appendages rather cylindrical and slightly curved, surface wholly covered with straight hairlike spines; apex bearing from twelve to fourteen short spinules. Basal segment of superior appendages well developed; distal segment slender, longer than the basal segment. Ædeagus consists of a posterior tubular arm, apparently flattened, and a shorter, anterior, slender, rodlike piece inclosed in a heavily chitinized sheath.

Length of body, 2.21 mm; width of head, 0.47; length of wing, 1.92; width of wing, 0.85; length of antennæ, 1.40.

Female.—Similar to the male in markings. Antennæ shorter than in the male, with nodes somewhat elongated; verticils of hairs not so dense as in male and tend to spread outward. Sensory spines simple, not elongated S-shaped, but projecting toward the internode. Ventral plate broad, emargination about as long as wide; lobes becoming pointed at their tips. Ovipositor about twice the width of the ventral plate.

Length of body, 2.54 mm; width of head, 0.49; length of wing, 2.00; width of wing, 0.96; length of antennæ, 0.95.

MARYLAND, Solomon Island, August 5, 1933 (*F. C. Bishopp's* light trap); College Park, August 5 and 26, 1933 (*F. C. Bishopp's* light trap). DISTRICT OF COLUMBIA, Washington, August 17 and 18 (*H. Barber*). VIRGINIA, Tapahamok, June 6, 1934 (*F. M. Prince*). NEW YORK, Sea Cliff (*N. Banks*, specimens determined as *Ps. superba* by Banks).

PSYCHODA SUPERBA Banks var. CONSPICUA var. nov. Plate 4, figs. 12 to 14.

From the typical form described in 1894 by Banks, this form differs as follows: Male antennæ with sensory spines very conspicuously shaped like a horn with two arms curved toward the node of the segment. The two spines are diametrically opposed on each segment of the antennæ. Vein Sc about one-third the length of R_1. Forks R_2R_3 and M_1M_2 in line with the ending of $Cu_2 + 2d$ A. Male genitalia with two spiracular openings on the ninth tergite. Inferior appendages each with nine to ten spinules at its apex.

The female is very similar to the female of the typical form in the structure of the tip of the antennæ, in the wing venation, and in the ventral plate.

Male.—Length of body, 2.23 mm; width of head, 0.51; length of wing, 2.00; width of wing, 0.94; length of antennæ, 1.31.

MARYLAND, Solomon Island, August 5 and 9, 1933; Annapolis, St. John College, August 12, 1933; College Park, August 14, 15, 17, and 20, 1933; Indian Head, August 20, 1933 (all specimens from Maryland are from *F. C. Bishopp's* light trap). VIRGINIA, Oxomore, August 20, 1933 (*F. C. Bishopp's* light trap).

PSYCHODA AUTUMNALIS Banks. Plate 4, figs. 15 to 20.

Psychoda autumnalis BANKS, Ent. News 25 (1914) 127–128.
Pericoma littoralis DYAR, Insec. Inscit. Menst. 14 (1926) 107–110.
Pericoma aldrichana DYAR, Insec. Inscit. Menst. 14 (1926) 107–110.

Male.—Head and thorax bronze, rather dull. Occiput broad with a median depression, the diverging sides gently convex, with yellowish white hairs. (In several specimens the yellowish white hairs have gray tips.) Eyes separated by a fine line. Frontal triangle much wider than long, with widely diverging sides on the upper thirds, of the same coloration as occiput, with a brush of thickly set grayish white to smoky hairs. Clypeus slightly longer than broad, thickly set with hairs like those of the frons. Proboscis short, with black pile near tip. Paraglossæ bulblike, membranous, slightly flexible with no constriction at the proximal margin, with six short teeth (three on each side) on the proximal portion and a group of long and short spines on the membranous area close to the tip. Theca distinctly heavily chitinized, Y-shaped; the cordlike stem of the Y forms a median line and the two arms diverge anteriorly. Furca weakly chitinized. Palpi and antennæ of same coloration as the head; segments of the palpi in the proportion of 25 : 35 : 34 : 40. Antennæ of sixteen segments, with dense whorls of dark gray hair, except that on segment 8 which is yellowish white or almost white; segment 1 large, becoming enlarged distally; segment 2 globular; segment 3 cup-shaped with short internodes, sensory spines finger-shaped, continuous around the node; remaining segments like segment 3 in structure and shape but gradually diminishing in size. Segment 16 with a long terminal spike, which is about as long as the width of the node, and a very short one, which is about one-fourth the length of the long one; both spikes bear short fine spines; anterior portion of the node bears several toothlike projections with minute spines.

Mesonotum uniformly bronzed except on the notopleuræ; dorsum with indications of two nearly parallel stripes crossing the length of the mesonotum (visible only with sufficiently high power); surface covered with long white hairs with grayish tips; medially they do not seem to be arranged in rows. Scutellum of same color as mesonotum, with long, erect, grayish white hair. Pleuræ dull brown. Hairs above halteres almost white. Knob of halteres dark with dark gray hairs; stem yellowish with yellowish white pruinescence. Wings a little over twice as long as broad, bluntly rounded at apex and terminating close behind the ending of R_4. Vestiture of wings dark gray with white spots giving a mottled appearance. White spots arranged about as follows: A large and a small spot on the anterior fringe at basal one-fifth and basal one-half of the wing,

respectively; small spots at tips of veins R_1, R_2, R_3, R_4, R_5, M_1, M_2, M_3, Cu_1, and Cu_2 + 2d A; a wide spot between M_1 and M_2 on the posterior fringe and a small spot at about the basal one-sixth of the wing; suggestions of three sinuous bands crossing the width of the wing, the first starting from the large spot on the anterior fringe, the second from the small spot at the middle of the anterior fringe, the third from the white spot at the tip of R_1. A denuded wing is conspicuous for the presence of distinctly pigmented areas on the veins, the pigmented areas are distributed as follows: On the tip of Sc and at the end of all the veins mentioned below; also a wide area on the fork of R_2R_3 and a small area before the fork; a small area midway between the fork and tip of R_2 and between the fork and tip of R_3; on R_4 there are about five dark areas; on R_5 one dark area basally; on M_1 there are four areas; on M_2 and M_3 there are two and five, respectively; on Cu_2 + 2d A one large area close to the one at its tip; the whole of 3d A is heavily pigmented. Wing venation: Sc long; origin of R_2R_3 at the level of r-m; fork R_2R_3 about the middle of the wing, much closer to fork M_1M_2 than to r-m. Stem of M_1M_2 of about same length as stem of R_2R_3, both forks a little after the extremity of Cu_2 + 2d A. Coxæ and trochanters fuscous brown, hairs almost white. Femora of forelegs strongly developed, sides in posterior view with three rows of bristles; pile on the outer surface gray, with scattered whitish hairs on the basal one-half of the anterior surface; undersurface with gray hairs; apically with a narrow white band. Fore tibiæ with dark gray hair and three distinct white bands, the band at basal one-third widest, the apical band narrow but distinctly snow white. First tarsal segment with dark gray hairs like those on the fore tibiæ; narrow, though very distinct, white bands basally and apically; the posterior edge with two rows of white scalelike hairs. Second tarsal segment white, the following two segments dark gray, the undersurface lighter. Middle and hind femora yellowish white on the upper surface, the apical one-third with dark gray hairs, without bristles on posterior border. Tibiæ and tarsi of mid- and hind legs with dark gray and white bands as on the forelegs.

Abdomen broadly bronzed dorsally, blackish beneath, the incisures pale brown; dorsum wholly covered with long, white, or pale yellowish white, hairs; venter basally with pale white hairs, towards the posterior end with dark gray hairs; lateral margin with either white, or a mixture of white and dark gray, hairs. Hypopygium of same coloration as the dorsum of the

abdomen with a mixture of white and dark gray hair. Ninth tergite about twice as broad as long, caudal flap triangular with distal end bluntly rounded. Inferior appendages stout, cylindrical, gently curved inwardly, almost twice as long as broad, bearing a tuft of from eight to ten spinules, sometimes arranged in rows of two or three; the spinules flat, heavily chitinized basally, their apices with very fine serrations. First segment of superior appendages stout, barrel-shaped, bearing two, long, slender spines on its inner surface; second segment strongly curved inwardly, its apex bearing a short spine. Ædeagus composed of two, slender, pointed processes, the longer about one-third longer than the shorter, their bases fused into a broad and heavily chitinized structure.

Length of body, 1.71 mm; width of head, 0.40; length of wing, 1.58; width of wing, 0.78; length of antennæ, 1.52.

Female.—Eyes at frons separated by a distance equal to twice the diameter of one facet. Antennæ differing from those of the male in that the nodes are much smaller and shaped like a club with a short neck. Whorls of white hairs on antennal segments 2, 8, 11, 12, and 16, the whorls on the remaining segments are dark gray and not appressed; basal segment of antennæ about twice as long as broad; 2 globular; 16 with a single terminal spike. Sensory spines with four to five branches, not continuous around the node but diametrically opposed. Thorax and abdomen of same coloration and structure as in the male. Wing venation, spots and speckling on the legs similar to those of the male. Ventral plate shallowly emarginate at apical end, terminating on each side in a well-marked lobe; each lobe bearing several spines. Anal flap attached to the ventral plate with a group of six fairly long spines (best seen under oil immersion).

Length of body, 2.03 mm; width of head, 0.43; length of wing, 1.92; width of wing, 0.80; length of antennæ, 1.16.

CALIFORNIA, Pacific Groove, May 6, 1906 (*J. M. Aldrich,* type of *Ps. littoralis* Dyar, type, *29388 U. S. National Museum*). ALASKA, Anchorage, June 15, 1921 (*J. M. Aldrich,* type of *Ps. aldrichana* Dyar, type, *29389 U. S. National Museum*). VIRGINIA, Onley, August 17, 1933 (*F. C. Bishopp's* light trap); Exomore, August 20, 1933 (*F. C. Bishopp's* light trap). MARYLAND, Solomon Island, August 7, 1933; College Park, August 14 and 17, 1933; Chesapeake Beach, July 28 and 29, 1933; Snowhill, July 13, 21, 25, and 27, 1933; August 1, 1933; Sep-

tember 26, 1933; Indian Head, August 6, 10, 12, 15, 16, and 20, 1933; Chestertown, July 22, 1933; Annapolis, St. John College, August 12, 1933 and September 7, 1933; Easton, August 16, 1933, and September 11, 1933 (all specimens examined from Maryland are from *F. C. Bishopp's* light trap). DISTRICT OF COLUMBIA, Washington, November 25, 1914 (*N. Banks*, type of *Ps. autumnalis* Banks, type, *13525 U. S. National Museum*), September 23, 1906 (*F. Knab*), October 8, without year (*Chittenden*).

The characteristic dark gray and white spots of the wings, the conspicuous annulated legs, and the structure of the male hypopygium of the specimens of *Ps. littoralis* Dyar, at once place this species as a synonym of *Ps. autumnalis*. *Psychoda aldrichana* was described by Dyar from a single denuded specimen. He described the legs of this specimen as dark, without mentioning the white and black bands characteristic of *autumnalis*. The denuded specimen also shows the faded mottled appearance of the wing produced by the black pigments on the wing veins, this character being observed in no other species of *Psychoda* except *autumnalis*.

PSYCHODA ALBIPUNCTATA Williston. Plate 5, figs. 1 to 6.

Psychoda albipunctata WILLISTON, Ent. News 55 (1893) 113.
Telmatoscopus meridionalis EATON, Ent. Mo. Mag. (1894) 195.
Psychoda snowii HASEMAN, Trans. Am. Ent. Soc. 33 (1907) 311–312.
Telmatoscopus albipunctatus (Williston) EDWARDS, Entomologist 66 (1928) 32.
Psychoda erecta CURRAN, Cat. Ins. Jam. Dept. Agr., Jamaica, Ent. Bull. No. 4, Parts 1 and 2, Append. (1926) 102.

Male.—Occiput and frontal triangle bronze, covered with whitish hairs which have grayish tints near their apices. Eyes at frons separated by a distance equal to about one and one-half times the diameter of one facet. Clypeus also bronze; slightly convex; with slight emargination on anterior margin; much broader than long; lateral margin with a row of four stout hairs. Proboscis bulblike, a little longer than the first palpal segment, clothed with short grayish black hairs. Paraglossæ with seven short teeth on each side of the lobe and over twelve long stout spines. Furca not well chitinized. Palpi dark brown, with dark gray hairs; palpal segments in the proportion of 5 : 20 : 12 : 15. Antennæ of sixteen segments, pale brown, with snow-white hairs; hairs on the nodes slightly compressed, although a few long hairs tend to spread outward; segment 1 stout, slightly longer than 2, which is globular, the whole surface

of segments 1 and the basal half of 2 covered with dark scalelike hairs; nodes of the middle segments of the antennæ much wider than long; last segment of similar shape except that the internode terminates in a spike with fine short hairs. Sensory spines on segments 3 to 16 composed of two long anterior branches, one on each side of the node.

Thorax pale brown; dorsum densely covered with whitish hairs which have grayish tints near their apices. Wings ovate, somewhat angulated at tip, about twice as long as broad. Hairs at basal one-seventh in the region of the base of the veins whitish, the hairs on the veins erect. Hairs on the semichitinous pad on costa and hairs on the alula whitish, some having the usual grayish color near the tips. Base of costa with blackish hairs, whitish at their apices, followed by a large patch of long white hairs. Anterior fringe brown, posterior darker. White pattern on the wings as follows: A large patch on the fork of $R_2 + R_3$ and another on the fork $M_1 + M_2$, the hairs on the latter nearly all erect; small patches at basal one-third of veins R_2 and R_3; small patches at about two-thirds of veins R_4, M_1, M_3; a medium-sized patch near the tip of vein $Cu_2 + 2d$ A. Tips of all veins except R_5 and $Cu_2 + 2d$ A with a few whitish hairs, which sometimes extend to the wing fringe. A distinct patch of erect blackish hairs before the white patch at the fork $R_2 + R_3$ and fork $M_1 + M_2$. Apex of wing also blackish. Wing fringe between whitish spots of tips of veins either blackish or smoky. Sc about as long as vein R, ending about the level of the origin of R_2R_3 on R_4. Origin of R_2R_3 distinctly before r-m. Fork M_1M_2 much closer to r-m than to fork R_2R_3. Knob of halteres blackish. Forelegs pale brown with white ring near the apical joint; tibiæ with short blackish hairs intermingled with white scalelike hairs; apically, near the joint, a ring of white scalelike hairs; tarsal segments with a prominent white ring on the apex of the first tarsal segment; last four tarsal segments blackish. Middle and hind legs similar to the forelegs, except that the apices of all the tarsal segments have white or nearly white hairs; tip of the last tarsal segment of the hind legs yellowish.

Abdomen blackish with dark yellowish brown hairs intermingled with yellowish white hairs. Hypopygium with long dark gray hairs. Ninth tergite heavily chitinized, about twice as long as broad, slightly longer than the inferior appendages. Anal flap evenly rounded, covered with short fine hairs. Inferior appendages stout, gradually tapering, apex bearing twelve

or more short spinules arranged in a single group. Basal segment of superior appendages stout, about as broad as long; apical segment slender, rather swollen basally, slightly curved at apex, which is pointed, bearing one or two short spines. Ædeagus consists of two well-chitinized, rather clawlike arms, loosely connected at their tips; basally the two arms terminate in a strong posterior arm.

Length of body, 2.00 mm; width of head, 0.69; length of wing, 2.50; width of wing, 1.23; length of antennæ, 1.00.

Female.—Differs from the male as follows: White scaling on antennal segment 2 very prominent; hairs on the nodes of the antennæ not very thickly set as in the male; white patches, especially the V-shaped, bandlike, white patches, at about the middle of the wing, more distinct than in the male; knee spots very conspicuous; dorsum of the abdomen near the posterior end with more white hairs; venter with blackish hairs. Ventral plate reddish brown, shallowly emarginated at apex.

Length of body, 2.50 mm; width of head, 0.80; length of wing, 2.80; width of wing, 1.50; length of antennæ, 1.90.

I have studied specimens of *Ps. albipunctata* in the United States National Museum from the following localities:

TEXAS, Brownsville, 1923 (*R. E. Tarbett*); Dallas, June 11, 1928 (*F. C. Bishopp*); Austen, 1919 (*J. M. del Curto*); Cuero, June, 1918 (*C. H. T. Townsend*). FLORIDA, Bradentown, March, 1913 (*M. C. Van Duzee*); Orlando, July 22 to 30, 1933 (*F. del Rosario*). LOUSIANA, Madison Parish, Tallulah, September, 1932 (*P. A. Woke*). BAHAMAS, Nassau, January, 1915 (*H. G. Dyar*). BERMUDA, October 24, 1931 (*H. H. Whetzet*). PANAMA CANAL ZONE, Summit, May, 1927 (*J. Zetek*). PORTO RICO, Cayey, August, 1928 (*W. A. Hoffman*); Rio Piedras, August 5, 1922 (*F. Sein*). HAITI, Port-au-Prince, November, 1928 (*R. C. Smith*). MEXICO, Oaz., Tuxtepex (*J. Camelo G.*); Oaz., Rio Antonio (*F. Knab*); Cordoba (*F. Knab*). WEST INDIES, St. Domingo, San Francisco Mountains, September, 1905 (*A. Busck*); Tobago Island, July (*A. Busck*); Trinidad, Port of Spain, June, 1911 (*A. Busck*). COSTA RICA, Alajuela, August, 1921 (*A. Alfaro*). BRITISH GUIANA, Georgetown, December 16, 1913 (*H. W. B. Moore*). JAMAICA, Kingston, September 24, 1903 (*M. Grabham*). CUBA, Baracao, September, 1907 (*A. Busck*).

Dyar (1926) states, "this species is widespread through the West Indies, and what is apparently the same has been taken in Florida, Texas and South Carolina, but the male genitalia

not compared." Haseman described as a new species (*Ps. snowii*) specimens collected at Galveston, Texas, differentiating this species from *Ps. albipunctata* by size, color pattern of the wings, snow-white antennæ, and knotted hair. Tonnoir (1920), who studied the collection of Psychodidæ in the British Museum, has published figures of the male wing and hypopygium of *Telmatoscopus meridionalis* Eaton. Edwards (1928) says, "Since Tonnoir's notes on the subject were published (Rev. Zool. Afr. Vol. VIII, p. 137, 1920), Tonnoir concluded that Willinston's *Ps. albipunctata* from Cuba is the same species, which should therefore be known as *Tel. albipunctata* (Will.)." In the same paper Edwards states, "It seems worth while to call attention to Tonnoir's discovery (that *T. meridionalis* Eaton is very widely distributed, not only throughout Africa, but also in the Mediterranean region, South America and the West Indies) because the same species has been re-described recently by Curran as *Ps. erecta;* the type (from Jamaica) has been received at the British Museum and proves to be a typical example of *T. albipunctatus.*" The hypopygia of the males, tips of the antennæ, wing venation, and color pattern of the wings of the specimens of *albipunctata* which I have studied, agree with the descriptions given by Haseman for *snowii* as well as with the figures given by Tonnoir for *T. meridionalis.*

PSYCHODA FUMATA Knab. Plate 5, figs. 7 to 10.

Psychoda fumata KNAB, Proc. U. S. Nat. Mus. 46 No. 2015, 1914 (1913) 103.

Male.—Occiput dark brown, rather broad, with gray hairs; a row of ten to twelve stout hairs on anterior margin. Eyes at frons nearly touching, distance of separation about one-third the diameter of one facet. Frontal triangle pale brown, clothed with yellowish gray hairs, these hairs confined to a circular area between the antennal fossæ. Clypeus brown, about twice as broad as long, lateral margins with six spines arranged in a single row, the rest of the surface covered with dark gray hairs directed toward the proboscis. Proboscis smoky, slightly longer than the first palpal segment, covering of hairs mostly dark gray. Paraglossæ bulblike, inner surface with three short teeth, outer surfaces with six long spines. Posterior stem of theca longer than its anterior arm. Palpi light brown with yellowish hairs; palpal segments in the proportion of 15 : 33 : 37 : 38. Antennæ of sixteen segments, brown, nodes with long gray hairs distinctly spreading outward; segment 1

slightly longer than 2, which is nearly spherical; node of segment 3 somewhat tapering posteriorly; nodes of segments 4 to 12 flask-shaped, internode longer than the node. Segment 13 globular, with a very short neck; segments 14 and 15 almost equal in size, spherical, with a shallow constriction separating them; segment 15 with a small toothlike projection bearing a small spine near its internode. Segment 16 rather ovoid with three to five short spines at its tip. Sensory spines on segments 3 to 13 composed of two long anterior branches and one posterior branch; the branches curved near their bases; anterior branch reaching to about two-thirds of the preceding node.

Mesonotum pale brown, clothed with long, erect, dark gray hairs, yellow near their bases. Wings lanceolate, over twice as long as broad, dark gray, with brownish tints; white patches near tips of R_1, R_2, R_3, M_3, and Cu_1; black spots on apices of R_1, R_2, M_3, Cu_1, and $Cu_2 + 2d$ A. Sc short, ending before the level of r-m. Origin of R_2R_3 on R_4 not very distinct and apparently before the level of r-m, the fork R_2R_3 after the middle of the wing. Fork R_2R_3 about as close to r-m as it is to fork M_1M_2. Knob of halteres blackish, stem yellowish. Legs pale brown, with smoky hairs. Fore and hind tibiæ with white bands at apex of the segment; the apical end of the first tarsal segment with white ring; the remaining tarsal segments uniformly blackish. Midtibiæ with white bands on their apices; first and second tarsal segments with white rings.

Abdomen yellowish brown, thickly clothed with hairs similar to those on thorax. Hypopygium pale brown, with dark hairs. Ninth tergite slightly longer than broad; width equal to the length of inferior appendages; anal flap appearing as two lobes, covered with short fine hairs. Inferior appendages moderately swollen basally and slightly tapering; apical portion with three short spines; terminal spinule about one-half the length of the appendage. Basal segment of superior appendages broad and stout, with a few hairs on the outer margin; apical segment longer than the basal segment, swollen basally and tapering to a slender apex, which is more or less pointed and bears two short spines. Ædeagus composed of one long tubular piece, lancetlike, and a short piece slightly curved at its apex. Basally the two pieces are fused together into a short heavily chitinized arm.

Length of body, 1.98 mm; width of head, 0.50; length of wing, 2.30; width of wing, 1.00; length of antennæ, 0.90.

MEXICO, Cordoba, 3 males, bred from bromeliads (*F. Knab*, type, *15934, U. S. National Museum*).

PSYCHODA HELICIS Dyar. **Plate 5, figs. 11 to 15.**

Psychoda helicis DYAR, Proc. Ent. Soc. Wash. 31 (1929) 63–64.

Male.—Occiput narrow, dark brown, covered with dark gray hairs. Eyes at frons almost touching. Frontal triangle broad. Clypeus wide, provided with five spines on the margin close to the eyes; shallowly emarginate at its anterior margin. Proboscis slightly longer than first palpal segment. Furca and theca heavily chitinized. Paraglossæ with three pairs of small spinelike teeth. Palpal segments in the proportion of 4 : 7 : 9 : 9. First palpal segment stout with a small patch of thick sensory hairs at about its basal half; remaining segments except the last segment have no sensory patch of hairs. Antennæ of sixteen segments; segment 1 short and strongly united to 2, which is globular; segments 3 to 12 flask-shaped; nodes more or less rounded; segment 13 with short neck; 14 and 15 of same size with short neck; 16 ovoid. Sensory spines diametrically opposed on the anterior end of each node of segments 3 to 14; each set of sensory spines is made up of two parts, each part having five, slender, leaflike branches, which are apparently intimately connected at their apices.

Thorax dark brown (all specimens denuded). Wings lanceolate, almost two and one-half times as long as wide, slightly pointed at apex. Sc about as long as the semichitinous pad above it. Origin of R_2R_3 on the same level as r-m; fork R_2R_3 a little before the middle of the wing, on the same level as the ending of vein $Cu_2 + 2d$ A, and much closer to fork M_1M_2 than to r-m. Vein R_5 well chitinized. Fork M_1M_2 before the middle of the wing, closer to the base than fork R_2R_3. Cell C + Sc darker and highly pigmented. Legs dark brown, apparently with dark gray hairs.

Abdomen dark brown, ninth tergite nearly as long as broad, slightly narrower at the base, and gradually distending medially; caudal flap semicircular in outline, distinctly hairy. Inferior appendages stout, about as long as the ninth tergite; outer margin covered with a thick set of short spines; inner surface with two long slender spines at its basal one-third; apex bearing two long spinules about two-thirds the length of the appendages. Basal segment of superior appendages broad, strongly developed; inner margin with a group of six fairly long spines; second segment clawlike; inner margin with a single, terminal,

hairlike spine. Ædeagus consisting of three pointed processes, the median piece directly connected to a heavily chitinized rod, the two other pieces slightly enlarged basally, both connected to a basal plate posteriorly at the bases of the superior appendages and ninth tergite.

Length of body, 1.21 mm; width of head, 0.38; length of wing, 1.45; width of wing, 0.60; length of antennæ, 1.24.

Female.—Resembles the male in coloration, structure of the antennæ, and wing venation. Eyes at frons separated by a distance equal to the diameter of one facet. Palpi with the three basal segments with a patch of sensory hairs, the patch on the second segment longest, running almost the whole length of the segment. Female genitalia with the ventral plate in the form of a tubular elongation covered with thick spines and microtrichia. Ovipositor reduced to two, broad, platelike pieces with blunt ends.

Length of body, 1.30 mm; width of head, 0.36; length of wing, 1.45; width of wing, 0.67; length of antennæ, 0.78.

CUBA, Central Jarona, September 26, 1927, males and female, type, *41186, U. S. National Museum* (*H. K. Plank*, through W. A. Orton, Division of Tropical Plant Research, reared from snails). MARYLAND, Solomon Island, August 9, 1933 (*F. C. Bishopp's* light trap); Snowhill, September 26, 1933 (*F. C. Bishopp's* light trap).

PSYCHODA TRIDACTILA Kincaid. Plate 5, figs. 16 to 19.

Pericoma tridactila KINCAID, Ent. News 10 (1899) 32.

Male.—Occiput dark bronze, densely clothed with long, erect, gray hairs. Eyes at frons separated by a distance about one-fourth less than the diameter of one facet. Palpi brown with short dark gray hairs; palpal segments in the proportion of 16 : 7 : 7 : 9. Paraglossæ bulb-shaped with four short spines on the inner surface of each lobe. Posterior stem of the theca nearly three times the length of the anterior arms. Antennæ of sixteen segments; nodes bronzed, verticils dark gray and almost compressed; segment 1 nearly as long as segment 2, which is spherical; segments 3 to 12 with their nodes flask-shaped, the diameter of the node about equal to the length of the internode; segment 13 with the node nearly of the same size as the node of segment 12 but with a very short internode; segments 14, 15, and 16 of about the same size, smaller than any of the nodes of the antennæ, separated from each other by a short, indistinct internode. Sensory spines on segments 3 to 13 of the usual

type, composed of two long anterior branches and one posterior branch.

Mesonotum bronze with gray hairs; pleuræ brown, with a few short gray hairs. Wings ovate, slightly acute at apex, wholly covered with fine gray hairs except for an irregular yellowish white band across the middle. Hairs on semichitinous pad close to the costa, dark gray. Anterior fringe uniformly grayish. Posterior fringe also grayish; towards the tip with indication of two yellowish areas. Tip of veins R_3, R_4, M_1, M_2, and M_3 with yellowish white hairs. Sc short, slightly broad at the tip, somewhat overlapping the base of R_1. Vein R_1 ending almost on the level of fork R_2R_3. Origin of R_2R_3 a little behind r-m, the fork being loosely connected. Fork M_1M_2 also loosely connected, distinctly before the middle of the wing and before the ending of vein Cu_2 + 2d A. Halteres dark brown; knobs with gray hairs. All legs light brown, covering of hairs gray, except on the tarsal segments, which appear yellowish when examined under diffused light.

Abdomen light bronze, dorsum with grayish hairs, sides and venter with yellowish gray hairs. Ninth tergite about twice as long as wide; anal flap small, evenly rounded, with a broad area shaped like a bag basally, surface covered with fine microtrichia. Inferior appendages cylindrical, slightly tapering apically to a rounded end; on the inner margin, near the base, is a long spinelike hair; apex bearing three long, clavate, somewhat equidistantly placed spinules, two of the spinules long, about two-thirds the length of the appendages, the other spinule slightly shorter than the outer two spinules. Superior appendages of two segments; basal segment cylindrical, about twice as long as broad; second segment slightly longer than the first, clawlike, tip pointed, with two rows of short, slender, spinelike hairs; extreme tip with a long hair, which is about two-thirds the length of the segment. Ædeagus composed of five pointed processes; one centrally placed, rather tubular piece, with an anterior median groove and ending posteriorly in a rounded end; this piece surrounded by four, slightly shorter, pointed pieces with their bases strongly united.

Length of body, 1.90 mm; width of head, 0.40; length of wing, 2.36; width of wing, 0.91; length of antennæ, 1.45.

Since no female has been examined, the original description of the female is here reproduced.

Female: Body light brown, densely clothed with gray hair. Wings ovated, one and one-half times as long as broad, apex moderately acute, clothed over the whole surface with gray hair, except an irregular band of white across the middle; fringe with basal third gray, remainder white, as long as the width of three cells; length of wing 2.5 mm. Legs light brown, clothed with gray hair and scales. Antennæ as long as the width of the wing, 16-jointed, with dense whorls of gray hair upon the nodes; joints 1–2 not larger than succeeding one; joints 3–15 globular separated by slender pedicles which are slightly longer than the length of the nodes; joints 14–16 minute, closely opposed. Ventral plate longer than broad, sides not emarginate, narrowing strongly toward the apex which is bilobate.

WASHINGTON, Seattle, 1 male, paratype, March 24, 1899 (*T. Kincaid*); Longmire Springs, 1 male, July 14, 1917 (*H. G. Dyar*).

PSYCHODA QUADRIPUNCTATA Banks. Plate 6, figs. 1 to 4.

Psychoda quadripunctata BANKS, Proc. Ent. Soc. Wash. 8 (1906) 148–151.

Female.—Head and thorax dark brown; occiput narrow, with short white hair. Eyes at frons separated by a distance equal to the diameter of three facets. Frontal triangle broadly widening toward the clypeus, covered with long, recumbent, dark grayish hairs; clypeus over twice as long as broad, with dark gray hairs, like those on the frontal triangle. Proboscis slightly longer than the first palpal segment, with dark grayish pile near the tip. Paraglossæ very much enlarged into bulblike lobes; each lobe apparently without any visible trace of the usual small spinelike teeth. Theca heavily chitinized, stem over three times the length of the anterior arms. Furca well chitinized, like the theca. Palpi dark brown, with short, recumbent, dark grayish white hairs similar to those found on the head. Palpal segments in the proportion of 7 : 10 : 9 : 14. Antennæ rather slender, of sixteen segments; nodes of basal one-half of the antennæ pale brown, verticils slightly compressed, pale brown; nodes of the apical portion lighter, verticils tending to spread outward. Second segment with grayish white hairs; diameter of the node equal to the length of the internode; terminal segment with terminal spike about as long as the diameter of the segment, covered with fine microtrichia. Sensory spines like those of *Ps. autumnalis* or *Ps. nigra* (female), with fingerlike branches usually from three to five in number.

Thorax dark brown, anterior mesonotum with white hairs. Pleuræ also dark brown. Knob of halteres wide, dark brown, with short, dark gray hairs; stem slender, pale yellow. Wings

lanceolate, over twice as long as broad, tip slightly angulated. Vestiture of brown or black and white hairs distributed as follows: A strip of erect white hairs occupying about basal one-third of R_1; a long strip of erect white hairs starting from origin of fork R_2R_3 and extending to about the middle of R_2 and R_3; another strip of erect white hairs on basal one-half of vein R_4; a short strip of erect white hairs on basal one-sixth of M_1 and followed by another shorter white strip at about the middle of the same vein; very distinct long strip of erect white hairs occupying nearly two-thirds of vein $Cu_2 + 2d$ A; black spots on tip of all veins except $Cu_2 + 2d$ A; black spots also located on R_2 and R_3 immediately following the ending of the white erect hairs, on M_2 just below the white on the middle of M_1; another black spot following the white on $Cu_2 + 2d$ A. All the other hairs on the veins are brown, except those on the tip of the anterior and posterior fringes, which are distinctly white, the white strip longer on the posterior than on the anterior fringe. Sc long, ending before the level of r-m; origin of $R_2 + R_3$ at the same level as r-m; forks R_2R_3 and M_1M_2 almost in line with the ending of $Cu_2 + 2d$ A. Fork R_2R_3 nearer to r-m than the fork M_1M_2. All legs brown, clothed with dark gray hairs except the apical third of all the tarsal segments, which are grayish or grayish white when examined under diffused light.

Abdomen dark brown, dorsum and sides with whitish hairs, towards the tip with grayish white hairs. Venter with a few black hairs. Ventral plate slightly narrowing near the base; lobes well produced, depth about one-third the distance between the lobes. Ovipositor about two and one-half times the width of the ventral plate, pointed, inner surface with a single row of short hairlike spines.

Length of body, 2.00 mm; width of head, 0.50; length of wing, 2.36; width of wing, 0.98; length of antennæ, 1.20.

VIRGINIA, Glencarlyn, 1 female, May, 1909 (*F. Knab*), determined by N. Banks as *Ps. quadripunctata* Banks.

PSYCHODA OLYMPIA Kincaid. Plate 6, figs. 5 to 8.

Psychoda olympia KINCAID, Ent. News 8 (1899) 144.

Pericoma olympia (Kincaid) HASEMAN, Trans. Am. Ent. Soc. (1907) 305–306.

Male.—Occiput bronze, densely covered with erect, dark gray hairs. Eyes at frons almost confluent, separated by a very fine line. Frontal triangle broad toward the clypeus, covered with light brown hairs arranged in groups in the middle of

the triangle; clypeus about twice as broad as long, slightly convex; convex surface covered with light brown hairs. Proboscis brown, slightly longer than the first palpal segment; lobes of paraglossæ well expanded, inner surface with eight short spinelike teeth on each lobe; outer margin with over twenty long and short spines. Theca well chitinized, stem a little longer than the anterior arms. Furca appearing as a broad chitinized strip. Palpi brown, with short dark gray hairs. Palpal segments in the proportion of 6 : 6 : 6 : 11. Antennæ of fourteen segments, nodes bronzed, verticils from each segment extending to the middle of the node of the preceding segment; segment 1 slightly longer than broad; 2 subglobular; 3 with the node elongated, the widest diameter at about the middle of the segment; segments 4 to 11 with long, slender internodes, the length of the internode longer than the diameter of the node; segment 12 with a short neck; segment 13 subglobular, smaller than 11 and with a very short neck; segment 14 slightly smaller than 13 and with a very small blunt projection bearing microtrichia. Sensory spines on segments 3 to 12 shaped like a slender, leaflike structure, two on each side of the node.

Mesonotum bronzed, densely covered with long dark grayish hairs (whitish when viewed from the sides); pleuræ pale brown with short whitish hairs and a few, long, dark gray hairs. Halteres bronzed with short dark gray hairs. Wings lanceolate, slightly angulated at tip. Anterior fringe mouse gray, tuft near the base mostly of long grayish hairs. Whole of Sc with erect white hairs. Bases of M_1M_2 and $Cu_2 + 2d$ A also with erect white hairs. Tips of all veins with dark mouse gray spots formed by dark gray hairs. Towards the apex an irregular black band runs across the wing starting from vein R_1. A patch of white hairs immediately behind the black band on the level of the fork of R_2R_3; an indistinct black fascia running across the width of the wing at about the middle. Hairs on the fork M_1M_2 mostly black or dark mouse gray, towards the base the hairs are dark brown. Posterior fringe longer than the anterior fringe and tending to spread. Sc long, ending at about the level of r-m. Origin of $R_2 + R_3$ on R_4 distinctly before r-m; fork R_2R_3 in line with the ending of $Cu_2 + 2d$ A, farther from r-m than fork M_1M_2. All legs brown with dark hairs; femora whitish when viewed by reflected light; tibiæ with a few scattered white hairs; tarsal segments with short grayish hairs.

Abdomen brown with long grayish hairs on the dorsum; towards the hypopygium the hairs become darker; sides and venter pale brown with grayish hairs. Ninth tergite slightly longer than broad, widening medially; caudal flap elongated and overlapping another small flap. Inferior appendages longer than the ninth tergite, swollen basally and gradually tapering toward the apex; apical end bearing thirteen to fifteen long and short spinules, the longest spinule about two-thirds as long as the swollen appendage; surface of the inferior appendages with hairlike spines. Superior appendages with the basal segment cylindrical, slightly curved inward and about twice as long as broad, with the inner surface near the base bearing a group of five short spines; apical segment clawlike, a little longer than the basal segment. Ædeagus consists of a tubular stem and anterior looplike portion which is inclosed by a thin chitinized sheath.

Length of body, 2.95 mm; width of head, 0.56; length of wing, 3.18; width of wing, 1.09; length of antennæ, 2.25.

WASHINGTON, Seattle, 1 male, March 27, 1898 (*T. Kincaid*), determined by T. Kincaid as *Ps. olympia* Kincaid.

PSYCHODA SNOWHILLI sp. nov. Plate 6, figs. 9 to 13.

Male.—Eyes at frons almost confluent. Frontal triangle apparently with the covering of hairs confined to a circular area between the antennal fossæ. Paraglossæ with four spinelike teeth on the inner surface of each lobe; outer surface of the lobe with about nine long spines. Palpal segments in the proportion of 5 : 7 : 8 : 9 : 5. Antennæ of fifteen segments; segment 1 longer than broad; 2 subspherical, about as broad as segment 1; segment 3 with the greatest diameter of the node at about the middle of the segment, with a subnode before the usual enlarged node, the length of the subnode equal to the length of the internode; segments 4 to 13 with the diameter of the node equal to the length of the internode; segment 14 with a short neck; segment 15 ovoid, about one-half as long as 14, with a short neck bearing two short spines at its apex. Sensory spines arranged like a comb, with an anterior and posterior row of ten to fourteen branches. The two processes are attached on each side of the node and almost encircle the node.

Wings lanceolate, pointed at apex, over twice as long as broad. Sc short. R_1 ending after the middle of the wing. Origin of R_2R_3 on R_4 very distinct and before r-m, the fork R_2R_3 before fork M_1M_2 and before the middle of the wing.

Fork M_1M_2 nearer to fork R_2R_3 than to r-m. Both forks before the ending of Cu_2 + 2d A.

Hypopygium: Ninth tergite over twice as broad as long; caudal flap almost rounded at its tip and with a short slender stem. Inferior appendages almost tubular, not curved, with a basal enlargement near the point of attachment to the ninth tergite; apex carrying three short spinules and a few short spines; those spines have serrated edges. Basal segment of superior appendages stout and well developed; apical segment swollen near the base and acutely pointed at its tip; near the tip with about five short and two long spines. Ædeagus consists of three pieces—a longer piece and two slightly shorter pieces coiled to the longer; posteriorly the three pieces unite into a single flat piece.

Length of body, 1.00 mm; width of head, 0.36; length of wing, 1.62; width of wing, 0.61; length of antennæ, 1.21.

MARYLAND, Snowhill, 1 male, July 25, 1933 (*F. C. Bishopp's* light trap).

With one denuded specimen to furnish data, the establishment of a species is a risky proposition. But when a form shows characters evidently different from any other known form, it seems quite permissible to describe and name the individual. The species is distinguished by the shape of the tip of the antenna, which bears a short spike carrying two short spines, by the peculiar arrangement of the sensory spines, by the shape of the third segment of the antenna, and by the form of the hypopygial appendages.

PSYCHODA BISHOPPI sp. nov. Plate 6, figs. 14 to 17.

Male.—Occiput brown with brown hairs. Eyes at frons separated by a distance equal to one-half the diameter of one facet; facets near the point of separation arranged in four rows. Frontal triangle dark brown with yellowish gray hairs, broadly widening towards the clypeus. Clypeus brown with yellowish white hairs, longer than those found on the palpi or proboscis. Proboscis brown with short yellowish gray hairs; proboscis slightly longer than the first palpal segment. Paraglossæ with four spinelike teeth on inner surface of each lobe and about seven long spines on outer surface. Palpi light brown with short, recumbent, yellowish gray hairs; palpal segments in the proportion of 12 : 23 : 28 : 33. Antennæ of sixteen segments; segment 1 about as long as broad; 2 subglobular; segments 3 to 13 with the diameter of the node equal to the length

of the internode; segment 14 intimately united to 15, which is ovoid and small. Sensory spines of the usual type having two anterior branches and one posterior branch.

Thorax bronzed, mesonotum with grayish hairs; pleuræ yellowish, anterior margin with a thick covering of gray hairs, hairs on the root of the wing and around the spiracle yellowish. Halteres dark yellow with dark gray hairs. Wings ovate, somewhat pointed at the tip, over twice as long as broad. Vestiture of hairs grayish throughout. Sc short. Origin of R_2R_3 on the same level as r-m, the fork R_2R_3 after the ending of $Cu_2 + 2d$ A. Fork M_1M_2 before the ending of $Cu_2 + 2d$ A, closer to fork R_2R_3 than to r-m. Legs uniformly clothed with grayish hairs; tarsal segments, especially around the joints, appear whitish in certain lights.

Abdomen pale brown, incisures whitish, covering of hairs grayish; venter with a few whitish hairs. Ninth tergite a little longer than wide; caudal flap evenly rounded with distinct microtrichia. Inferior appendages rather tubular but slightly enlarged basally; apically bearing five spinules of equal size, the length of the spinules a little over one-half the length of the appendage. Basal segment of superior appendages longer than wide, on the inner surface near the base is a group of about seven short spines; apical segment about as long as the basal segment, slender and pointed, the apex bearing a single hairlike spine. Ædeagus consists of one short piece, slightly notched at its extreme tip, and two pointed lateral pieces which have a broad base giving a triangular shape. The whole ædeagus is triangular in general appearance, except for the posterior prolongation which is more or less tubular.

Length of body, 1.25 mm; width of head, 0.36; length of wing, 1.64; width of wing, 0.67; length of antennæ, 1.23.

MARYLAND, College Park, 2 males, September 9, 1933; Chesapeake Beach, 1 male. All the specimens were collected in F. C. Bishopp's light trap.

In addition to the species described above there are several species described by other authors as belonging to the genus *Psychoda* that in all probability belong to the genus *Pericoma*, and some species described as *Pericoma* in all probability really belong to *Psychoda*. In the absence of the types it is very difficult to identify the species. All the descriptions, especially those given by other authors, are very deficient, so that it is

almost useless to attempt to identify the species without examining the types. It must be left to future workers who have access to the types (if they still exist, which is doubtful) to determine the synonymy. A few remarks on these species, however, may not seem out of place here.

PSYCHODA ANGUSTIPENNIS Williston.

This may be the same species as *Ps. quadripunctata* Banks, as the author mentions the "wing having a small tuft of white at the extreme tip; another larger one on each side beyond the middle, and yet another towards the base on the posterior margin," but these would be the only characters by which the identity could be established, as the remaining parts of the description may be considered too general. St. Vincent, West Indies. Location of type unknown.

PSYCHODA PALLENS Williston.

This species has been made a synonym of *Ps. phalænoides* Linn. by Dyar (1926), who gave no reason whatsoever for doing so. Since Williston described the antennæ as rather slender, he may have been dealing with a *Pericoma*. The presence of "a minute blackish spot at the tip of the wing" might help to identify this species to a certain extent. St. Vincent, West Indies. Location of type unknown.

PSYCHODA PUNCTATELLA Williston.

From the description of the wing as "having eight small black spots on the margin of the wing" and by the fact that the antennæ were said to be stout and thickly clothed with white hairs, this species might be either *Ps. albipunctata, Ps. superba,* or *Ps. autumnalis,* although in these species the legs have rings or bands of white hairs; the legs of *punctatella* were said to be grayish brown (probably referring to the color of the integument). Vera Cruz, Mexico. Location of type unknown.

PSYCHODA ANNULIPES Johnson.

Judging by the mention of the wing as having "numerous small tufts of erect black hairs along the veins in the center of the wing and by the tibiæ being conspicuous annulated" it seems probable that this is nothing else than *Ps. autumnalis.* Should this prove to be the case, the form to which the name *Ps. autumnalis* is here assigned would become *Ps. annulipes* Johnson. Ormond, Florida. Holotype in Johnson's collection; allotype in Mrs. Slosson's collection.

PSYCHODA ANTENNALIS Williston.

This evidently is a true *Psychoda* as shown by the words "antennæ stout, the joints moniliform." St. Vincent, West Indies. Location of the type unknown.

PSYCHODA SQUAMOSA Johnson.

The fact that the wing was described as being grayish and quite thickly covered with blackish scales indicates that this species may probably be *Ps. nigra.* Florida, type in Johnson's collection.

PSYCHODA ATERRIMA Banks.

Evidently a true *Psychoda,* as the author differentiates it from his species *Ps. nigra* because of its deeper black color, longer hair, and narrower wings. In all other respects the description is not sufficiently clear to enable one to ascertain with what species it corresponds. Ithaca, New York. The type is in Banks's collection.

PSYCHODA MINUTA Banks.

This is evidently a true *Psychoda* and, as stated above, might possibly be the species I am describing as *Ps. uniformis.* Sea Cliff, New York, and Mesilla, New Mexico. Location of type not stated (probably in Banks's collection).

PSYCHODA HORIZONTALA Haseman.

Haseman's description of the wings, male genitalia, and antennæ might apply to *Ps. cinerea.* The fact that his descriptions were drawn from two males taken on the laboratory window suggests that he was dealing with a species commonly found in buildings. (*Psychoda cinerea* is one of the common species found inside houses.)

PSYCHODA LONGIFRINGA Haseman.

This species is evidently a *Psychoda* as the author mentions "Antennæ 13-jointed; 1–2 short, stout; 3–13 each with basal enlargement . . .; terminal spike of 13 long, with perceptible enlargements; . . ." The 13-jointed antenna is not characteristic of *Psychoda,* so that probably the tip of the antenna had been broken. The "single strong clavate tentacle, sickle-shaped," might to a certain extent apply to my *Ps. interdicta.* Lake City, Florida. Location of type not stated (probably in Haseman's collection).

PSYCHODA UNIFORMATA Haseman.

As stated above, this species might be the same as the one I am describing as *Ps. interdicta* or *Ps. uniformis.* Columbia, Missouri. Type probably in the author's collection.

PSYCHODA DURIPUNCTATA Curran.

This species was made a synonym of *Brunettia albonotota* (Brun.) by Edwards (1928) after he had received Jamaican specimens, apparently from Curran and labeled *Ps. duripunctata* Curran.

PERICOMA FURCATA Kincaid.

This might be a *Psychoda* judging from the description, "antennæ 16-jointed; joints 1–2 slightly larger than the succeeding ones; joints 3–16 swollen at base." The statement "legs with alternate annulation of black and white hair" might suggest that it was *Ps. autumnalis*. Pullman, Washington. Location of type unknown.

PERICOMA TRIALBAWHORLA Haseman.

In describing this species Haseman states that nodes 8, 12, and 17 of the antennæ have whorls of snow-white hairs. This description might apply to the female antennæ of the species recognized as *Ps. autumnalis*, except that the number of segments of the antennæ in the former is said to be seventeen; *Ps. autumnalis* has sixteen. Columbia, Missouri. Location of type not given (probably in the author's collection).

PERICOMA SCALA Haseman.

The description of the antennæ is as follows: "antennæ 16-jointed; length 1.15 mm.; basal joint strong, cylindrical; second joint smaller than first, spherical; 3–15 with basal enlargement, about equal in length to the strong pedicles; 16 closely joined to 15, spherical, with short terminal spike; . . ." From the above description it is clear that the author was dealing with a *Psychoda*.

I have also found the following species described as *Psychoda* to be true *Pericoma* from examination of the specimens in the United States National Museum:[2]

[2] For differentiating the genus *Psychoda*, I have followed Tonnoir's characters of the genus, which may be briefly summarized as follows:

Psychoda.—Antennæ of fourteen to sixteen segments; segments of flagellum, except 13, having a basal spherical bulb and a long neck; these segments carrying a large cupuliform verticil of curved bristles; from segment 14 the terminal segments are quite diminutive and may be partially or completely soldered together.

Pericoma.—Antennæ usually of seventeen segments; segments of flagellum usually fusiform; last segment not diminutive and always provided with a spike.

Psychoda (*Pericoma*) *alberta* Curran.	*Psychoda albitarsis* Banks.
	Psychoda alfaroana Banks.
Psychoda (*Pericoma*) *augusta* Curran.	*Psychoda amplipenna* Knab.
	Psychoda busckana Dyar.
Psychoda (*Pericoma*) *criddlei* Curran.	*Psychoda grabhamana* Dyar.
	Psychoda incompleta Knab.
Psychoda (*Pericoma*) *juno* Curran.	*Psychoda interrupta* Banks.
	Psychoda nitida Banks.
Psychoda (*Pericoma*) *scotia* Curran.	*Psychoda slossoni* Williston.
	Psychoda tricolor Knab.

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[3] Other references are given in the systematic discussion.

ILLUSTRATIONS

Plate 1

Figs. 1 to 5. *Psychoda alternata* Say; *1*, venation, male; *2*, tip of antenna, male; *3*, tip of labium (only one lobe), male; *4*, ventral plate, female; *5*, hypopygium, male.

6 to 10. *Psychoda phalænoides* (Linnæus) Tonnoir; *6*, venation, male; *7*, tip of antenna, male; *8*, tip of labium, male; *9*, ventral plate, female; *10*, hypopygium, male.

11 to 15. *Psychoda cinerea* Banks; *11*, venation, male; *12*, tip of antenna, male; *13*, tip of labium, male; *14*, ventral plate, female; *15*, hypopygium, male.

16 to 21. *Psychoda severini* Tonnoir; *16*, venation, male; *17*, tip of antenna, male; *18*, tip of labium, male; *19*, ventral plate, female; *20*, hypopygium, male; *21*, tip of antenna, female.

Plate 2

Figs. 1 to 5. *Psychoda pusilla* Tonnoir; *1*, venation, male; *2*, tip of antenna, male; *3*, tip of labium, male; *4*, ventral plate, female; *5*, hypopygium, male.

6 to 11. *Psychoda grisescens* Tonnoir; *6*, venation, male; *7*, tip of antenna, male; *8*, tip of labium, male; *9*, ventral plate, female; *10*, hypopygium, male; *11*, hypopygium (dorsal view), male.

12 to 16. *Psychoda interdicta* Dyar; *12*, venation, male; *13*, tip of antenna, male; *14*, tip of labium, male; *15*, ventral plate, female; *16*, hypopygium, male.

17 to 21. *Psychoda marylandana* sp. nov.; *17*, venation, male; *18*, tip of antenna, male; *19*, tip of labium, male; *20*, ventral plate, female; *21*, hypopygium, male.

22 to 25. *Psychoda uniformis* sp. nov.; *22*, venation, female; *23*, tip of labium, female; *24*, tip of antenna, female; *25*, ventral plate, female.

Plate 3

Figs. 1 to 4. *Psychoda sigma* Kincaid; *1*, venation, female; *2*, tip of antenna, female; *3*, tip of labium, female; *4*, ventral plate, female.

5 to 10. *Psychoda bicolor* Banks; *5*, venation, male; *6*, tip of antenna, male; *7*, paraglossa, male; *8*, ventral plate, female; *9*, spines on anal flap of ventral plate, female; *10*, hypopygium, male.

11 to 16. *Psychoda nigra* Banks; *11*, venation, male; *12*, tip of antenna, male; *13*, paraglossa, male; *14*, ventral plate, female; *15*, hypopygium, male; *16*, tip of antenna, female.

PLATE 4

FIGS. 1 to 5. *Psychoda opposita* Banks; *1*, basal segments of antenna, male; *2*, hypopygium, male; *3*, venation, male; *4*, ventral plate, female; *5*, paraglossa, male.

6 to 11. *Psychoda superba* Banks; *6*, venation, male; *7*, tip of antenna, male; *8*, hypopygium, male; *9*, paraglossa, male; *10*, tip of antenna, female; *11*, ventral plate, female.

12 to 14. *Psychoda superba* var. *conspicua* var. nov.; *12*, venation, male; *13*, hypopygium, male; *14*, tip of antenna, male.

15 to 20. *Psychoda autumnalis* Banks; *15*, tip of antenna, female; *16*, hypopygium, male; *17*, ventral plate, female; *18*, venation, male; *19*, paraglossa, male; *20*, tip of antenna, female.

PLATE 5

FIGS. 1 to 6. *Psychoda albipunctata* Williston; *1*, venation, male; *2*, tip of antenna, female; *3*, tip of antenna, male; *4*, ventral plate, female; *5*, hypopygium, male; *6*, paraglossa, male.

7 to 10. *Psychoda fumata* Knab; *7*, venation, male; *8*, hypopygium, male; *9*, tip of antenna, male; *10*, paraglossa, male.

11 to 15. *Psychoda helicis* Dyar; *11*, venation, male; *12*, ventral plate, female; *13*, tip of antenna, male; *14*, paraglossa, male; *15*, hypopygium, male.

16 to 19. *Psychoda tridactila* Kincaid; *16*, paraglossa, male; *17*, tip of antenna, male; *18*, venation, male; *19*, hypopygium, male.

PLATE 6

FIGS. 1 to 4. *Psychoda quadripunctata* Banks; *1*, venation, female; *2*, paraglossa, female; *3*, tip of antenna, female; *4*, ventral plate, female.

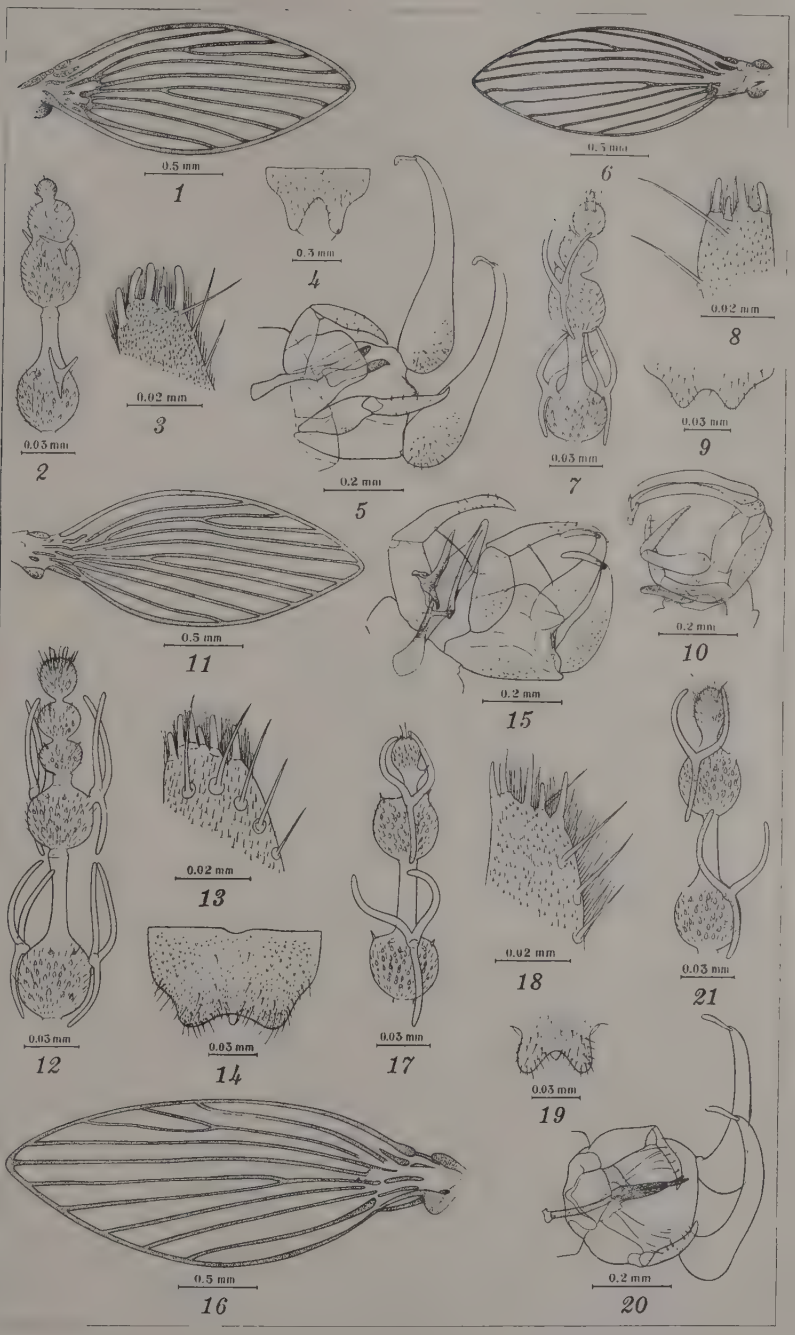
5 to 8. *Psychoda olympia* Kincaid; *5*, venation, male; *6*, tip of antenna, male; *7*, paraglossa, male; *8*, hypopygium, male.

9 to 13. *Psychoda snowhilli* sp. nov.; *9*, venation, male; *10*, tip of antenna, male; *11*, basal segments of antenna, male; *12*, paraglossa, male; *13*, hypopygium, male.

14 to 17. *Psychoda bishoppi* sp. nov.; *14*, venation, male; *15*, tip of antenna, male; *16*, paraglossa, male; *17*, hypopygium, male.

TEXT FIGURE

FIG. 1. Wing venation of *Psychoda*, showing terminology adopted for veins and cells.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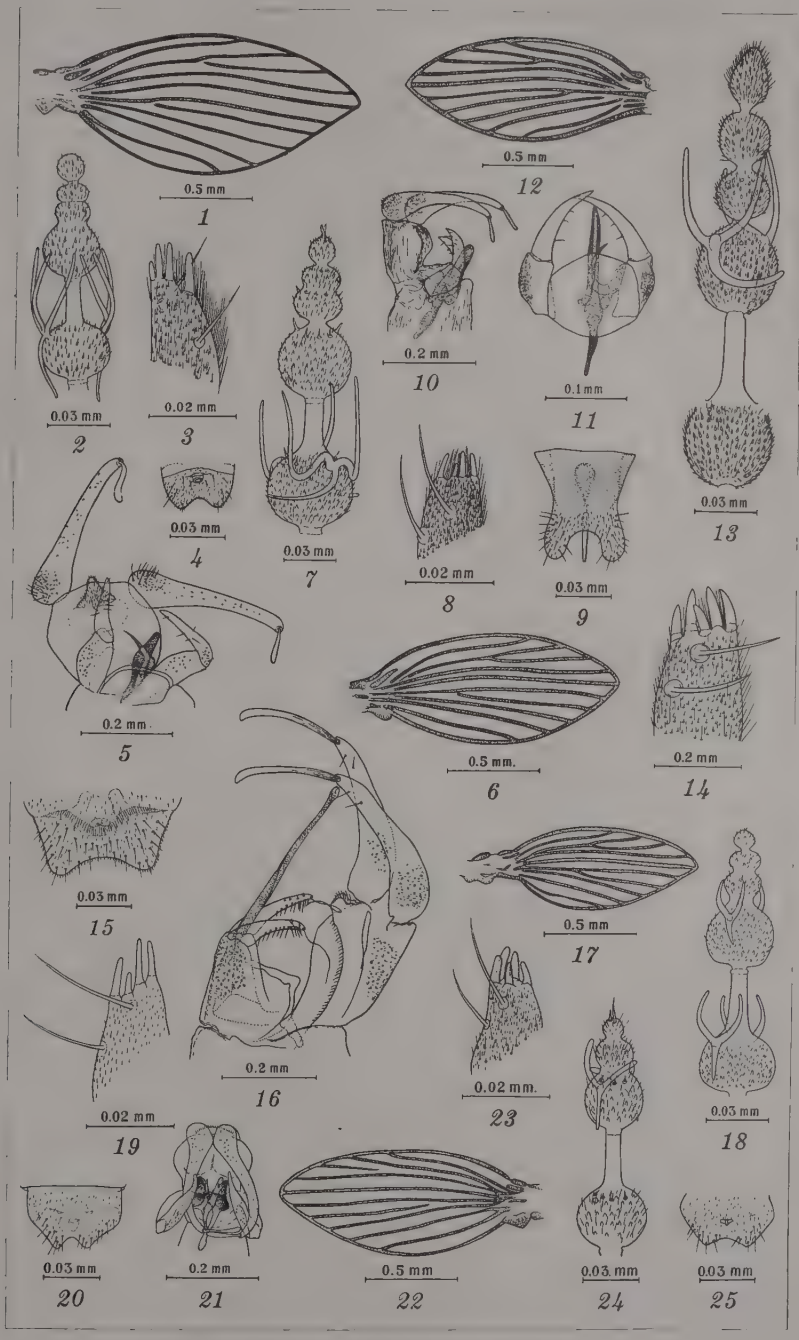
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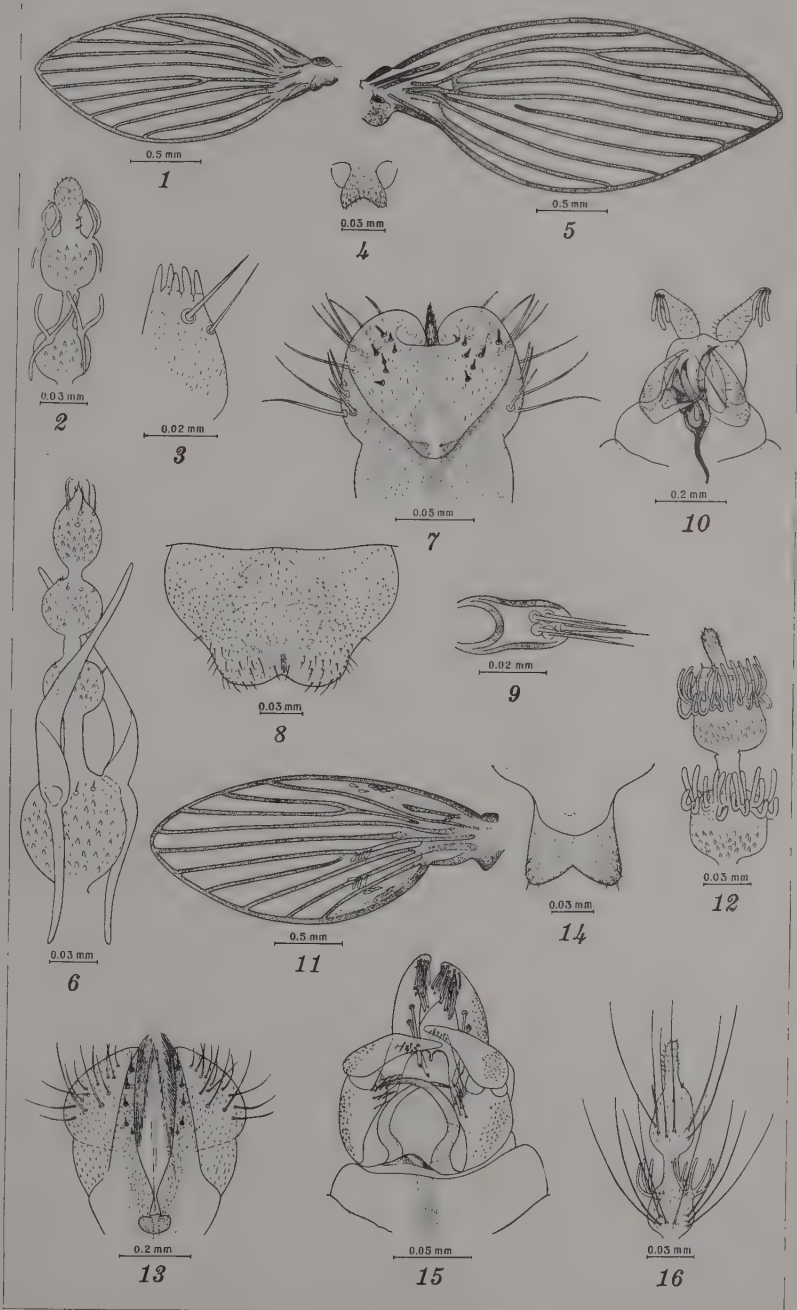
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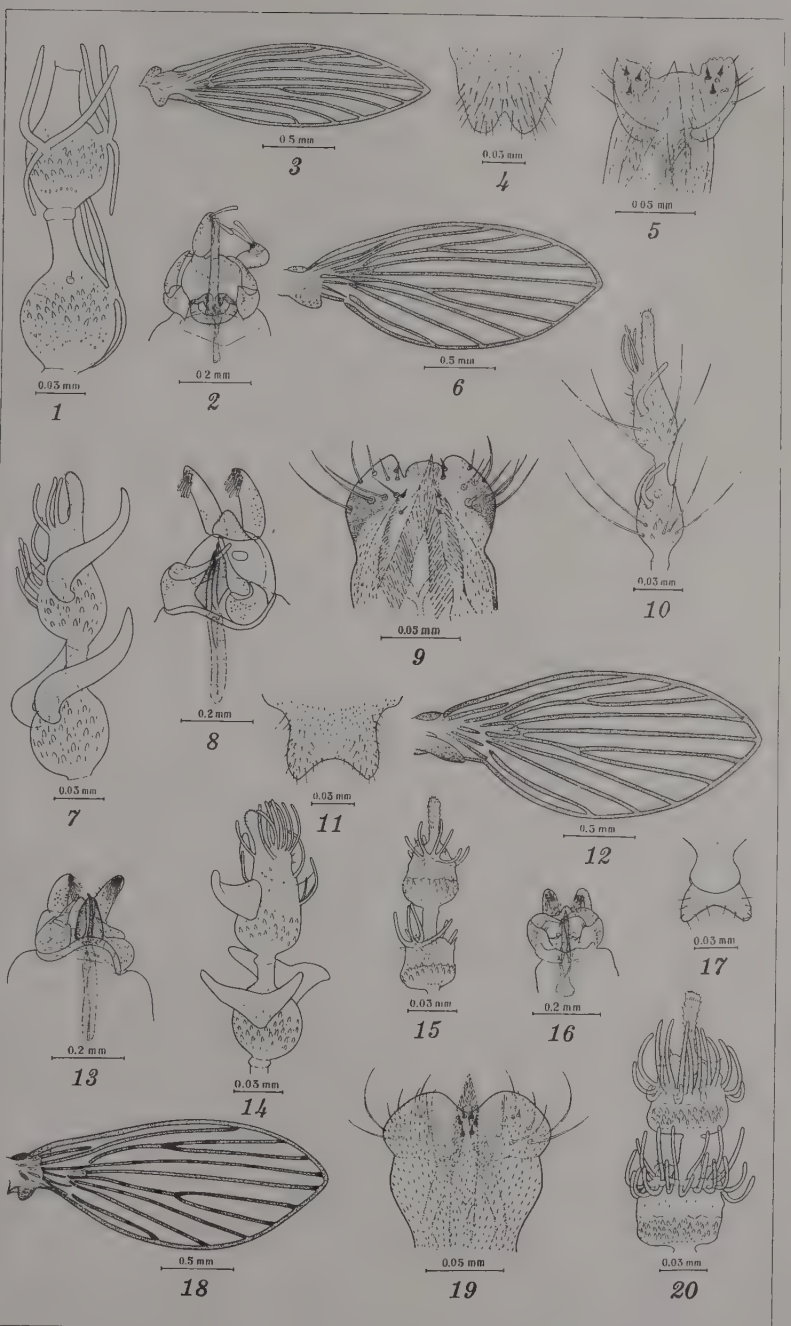
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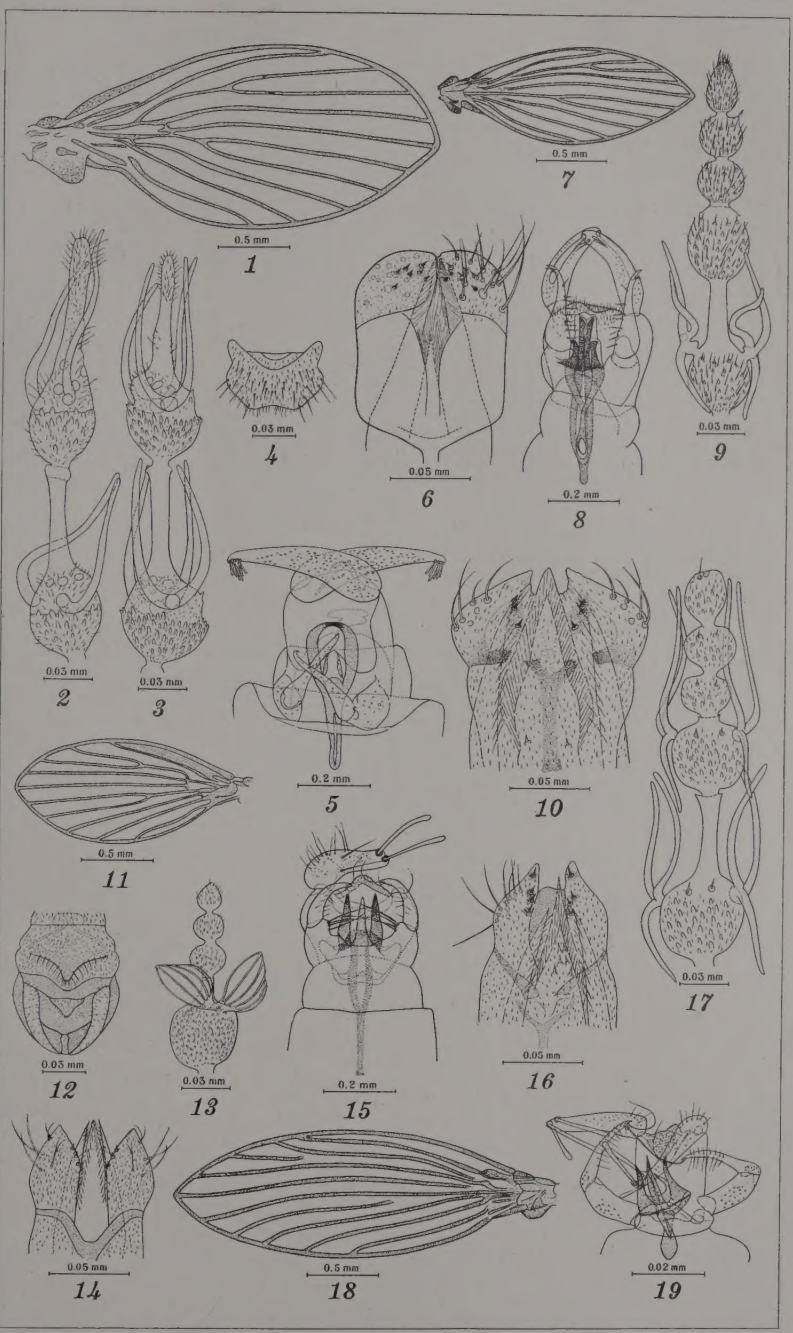
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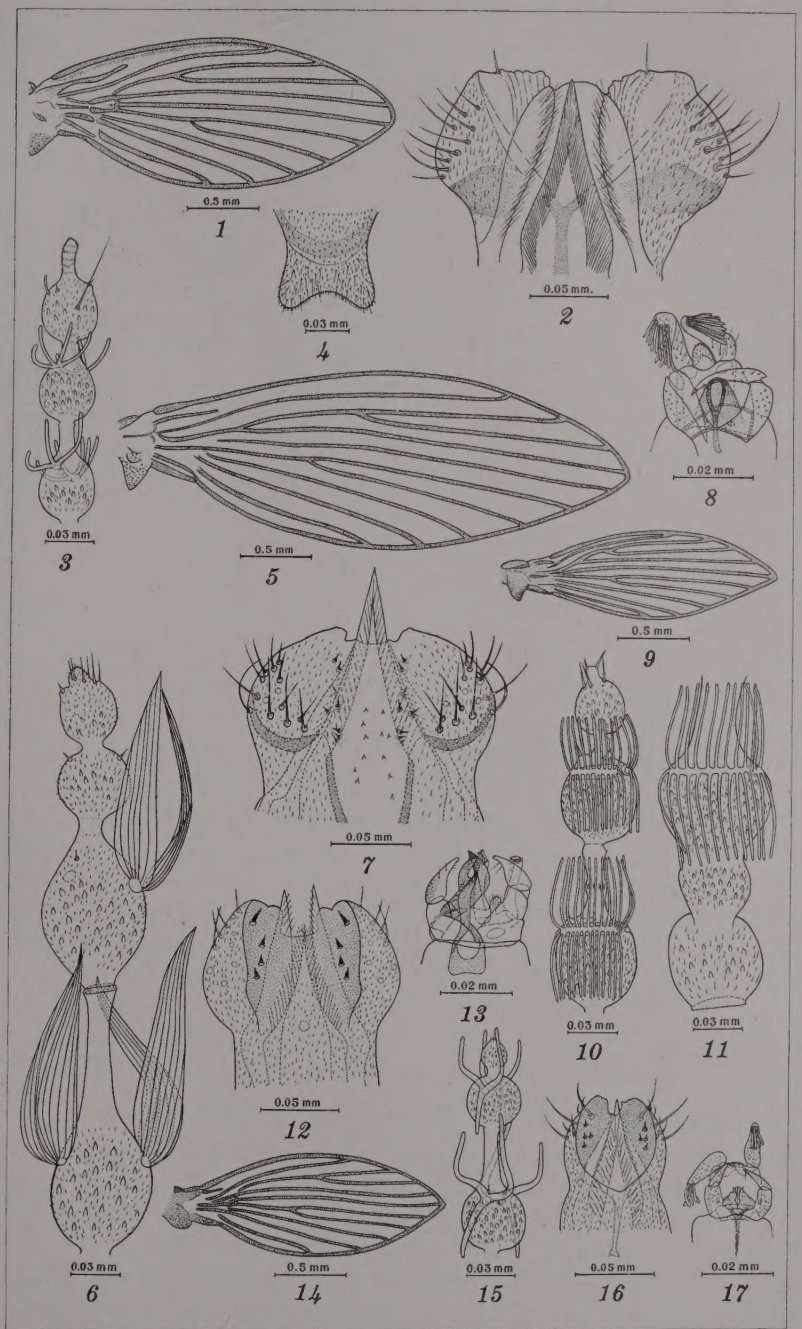
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PLATE 6.